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Contents

As The Editor Sees It 5
The U. G. I. Challenges Utility Act
The Public Utility Act Decision
The Washington Gas Rate Plan
A New Era of Gas Advertising

Industrial Furnace Atmospheres—C. George Segeler 9

Regulator Structures—Erick Larson 13

Three National Gas Appliance Campaigns for 1936 16

"The Mystery Chef" Broadcasts Begin 17

Tentative Approval Requirements for Gas Hair Dryers Completed by A.G.A. Committee 18

Customers' Accounting System Public Service Electric and Gas Company—John L. Conover 19

Low-Cost Oxygen for Gasification of Fuels—Theodore Nagel 22

The Future of the Small Gas Company—Ellis Mills 23

Book Reviews 24

Domestic Gas Utilization—Charles W. Merriam, Jr. 25

Value of Photographic Enlargements in Window Displays—Stuart Bratesman 29

"Successful Selling"
Intensive Water Heating Drive Brings Good Results—Winfield Foster 30

2643 Automatic Water Heaters Sold in Two Months—C. L. Trevitt 31

Dealer Enthusiasm and Sportsmanship Outstanding Feature of Range Campaign—F. S. Dewey 31

The Human Side—John J. Stapp 32

The Small Gas Steam Boiler Load—J. H. Bell 33

Use of "Carboseal" to Reduce Gas Main Leakage 34

News of the Gas Industry 35

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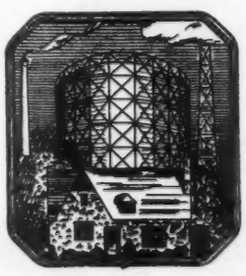

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"LONG LIFE PIPE"

with gas-tight mechanical joints

Two things are certain about cast iron bell-and-spigot pipe and the stuffing-box type mechanical joint—*long life and a bottle-tight joint.* History proves that cast iron is beyond comparison as a long-lived material for underground mains. Rigid tests conducted by the laboratory of the American Gas Association demonstrate that the stuffing-box type mechanical joint as made by our members is bottle-tight.

The Cast Iron Pipe Research Ass'n, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Bldg., Chicago, Ill.

CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

AS THE EDITOR SEES IT

The U. G. I. Challenges Utility Act

DECEMBER 1 was the date before which the utilities were required to register with the Securities and Exchange Commission. The number of registrations was negligible. Government officials were uneasy, and Judge Coleman's decision added to their concern. What action would the utilities take?

The action of the United Gas Improvement Company was the answer. On November 20, this company, the oldest and one of the most conservatively managed utility holding companies in the United States, with assets of over $815,000,000 and with more than 122,650 stockholders, gave notice that it would not register and at the same time applied for an injunction to prevent enforcement of the Act.

In a letter to the U.G.I. stockholders Mr. John E. Zimmerman, President of the Company, pointed out that registration under the Act "may not only irrevocably deprive the Registrant of its constitutional defenses against the enforcement of the Act but automatically subjects such holding company and its subsidiaries to numerous devastating and throttling provisions and in effect transfers to the Securities and Exchange Commission the normal duties of operation and management now lodged with the officers and directors of your Company and those of its subsidiaries."

The action of the U.G.I. was followed by assurances from the Securities and Exchange Commission that no criminal prosecutions were contemplated, that only a few test cases would be brought and they would be handled in an orderly manner, and finally that registrations would be accepted with the understanding they would be voided if any court held any rights were impaired by such registration.

These were no real concessions to the utilities, but merely efforts to prevent them from proving that they would suffer irreparable injury if they were to register. In this way the Securities and Exchange Commission evidently hopes to ward off injunctions and force registration. If registration is actually effected the Commission apparently believes it will be in a better position to pick the company with which to fight a test case. Naturally this would be the one which would make the weakest showing from standpoint of the utility industry. The utilities quite properly are determined to block any such effort if it is at all practicable.

The Public Utility Act Decision

IT was inevitable that the Public Utility Act with its drastic provisions should be promptly challenged in the Courts; and it was not unexpected that it should have been declared unconstitutional. Care and unbiased legislative consideration were lacking in both the framing and the passage of the Act. Prejudice and political pressure ruled instead, and the result was a hodge-podge of restrictions on intrastate as well as interstate utility business. Many eminent attorneys considered them far outside the regulatory powers granted to Congress by the Constitution, and now a Federal Court has confirmed that view.

The case itself was perhaps unusual. A small utility holding company was seeking to reorganize under direction of the Court. The Public Utility Act appeared to prevent the consummation of its plans. It presented the matter to the Court, and the Court told it to disregard the Act as it was clearly unconstitutional.

The case is being appealed and will probably reach the Supreme Court of the United States. The government apparently will fight it hereafter largely on technicalities. Whatever may be the eventual decision, the summary presented by Judge Coleman as part of a lengthy opinion which he rendered on November 7, 1935, in the District Court of the United States for the District of Maryland is so clear as to the merits of the Act that we reprint it in full in these columns.

"In the Matter of the Petition of the Trustees of the Debtor Corporation, American States Public Service Company, for Instructions with Respect to Their Duties in Relation to the Public Utility Act of 1935.

SUMMARY BY THE COURT

"I. The question as to the validity of the Public Utility Act has been directly and properly raised. There has been no collusion between the parties. There is a real and not a fabricated conflict of parties and interests. There is nothing premature about the proceeding. On the contrary, there is an actual, pressing need for a prompt ruling upon the Act's validity, because of the fast-approaching date when the Act, with its multifarious, drastic requirements, becomes effective; and because, until such ruling is had it cannot be determined whether the pending reorganization proceedings are a futility, or should be progressed to a conclusion as this Court has directed.

"II. The Public Utility Act is invalid in its entirety for the following reasons:

"A. Congress, by its enactment, has flagrantly exceeded its lawful power under the Commerce Clause of the Constitution in that the provisions of the Act are, neither by their express language nor by any reasonable implication, capable of being restricted to the regulation of public utility holding companies and their subsidiaries or affiliates, when engaged in interstate commerce or in transactions that directly affect or burden interstate commerce. The Act aims to regulate virtually everything that such companies do, intrastate as well as interstate. All of the companies before the Court are embraced within the Act's provisions, although none of them does any interstate business, or is engaged in any intrastate business that directly affects or burdens interstate business.

"The theory upon which the Act is predicated is that public utility holding companies and their subsidiaries are affected with a "national public interest." But under the Constitution there is no "national public interest" which permits of federal regulation, unless the person, corporation or thing affected with such interest is, in fact, involved directly, not indirectly, in some activity over which the Federal Government, through one or more of the powers delegated to it by the Constitution, has jurisdiction. If the Constitution be construed to permit what the Public Utility Act aims to accom-

plish, then federal authority would embrace practically all the activities of the people, and the authority of the States over their domestic concerns would exist only by sufferance of the Federal Government.

"B. Congress, by its enactment, has exceeded its lawful authority under the postal power granted to congress by the Constitution, in that the Act arbitrarily and unreasonably denies completely the use of the mails to all persons and corporations embraced within the Act with respect to all of their activities, as a penalty for non-compliance, and a means of compelling compliance, with the Act's requirements, regardless of whether any particular use of the mails or any particular thing mailed, is in fact of such character as reasonably to warrant exclusion. That is, the exclusion bears no relation necessarily to the use itself, but to the user, of the mails.

"C. Congress, by its enactment, has flagrantly violated the requirements of due process of law under the Fifth Amendment to the Constitution in that many of the Act's provisions are grossly arbitrary, unreasonable and capricious, because of the penalties which they impose for non-registration with the Securities and Exchange Commission; the restraints placed upon the issuance and acquisition of securities, etc.; the regulations and prohibitions with respect to service, sales and construction contracts; the taking over of virtually the entire management of the affairs of the companies embraced by the Act; and the elimination or simplification of holding company systems.

"D. The invalid provisions of the Act, in spite of separability clause, are so multifarious and so intimately and repeatedly interwoven throughout the Act as to render them incapable of separation from such parts of the Act, if any, as otherwise might be valid. The Court cannot rewrite the statute and give it an effect altogether different from that necessarily produced by its provisions viewed as a whole. Invalid parts of a law may be dropped only if what is retained is fully operative as a law. In the Public Utility Act, invalid provisions are the rule rather than the exception. If dissection is attempted, scarcely a clause survives save, perhaps, the preamble.

"III. The question whether Congress, by the Act, has also unlawfully delegated to the Securities and Exchange Commission, without establishing adequate and intelligent standards to guide and assist it, the legislative power to determine when and to what persons and corporations the Act shall apply, has not been considered by the Court because unnecessary in view of the other grounds upon which the Court rests its decision."

The Washington Gas Rate Plan

LAST month we carried in the JOURNAL the story of the agreement between the City Fathers of Detroit and the Detroit City Gas Company to establish a sliding scale form of rate regulation. Now comes the word that the District of Columbia utilities commission has tentatively approved the adoption by the Washington Gas Light Company of a modified "Washington Plan." Profit sharing rate plans apparently are receiving favorable consideration both by the gas industry and by the regulatory authorities.

All of this appears to be evidence of a trend in the right direction. Theory as well as practice indicate that a properly established profit sharing rate plan does work to the advantage of both the company and its customers. Likewise there is little question that the company is kept well out of politics; that the company and the public are saved much expense by the elimination of rate controversies and that the company management is able to devote its attention to the gas business rather than to squabbles.

Profit sharing plans are by no means a new development. They have been used in Great Britain for more than three quarters of a century. It is true that in their earlier forms they had two rather serious defects: They failed to recognize either the possibility of changing price conditions or the need for promotional rate forms. War time prices and competition from electricity and other fuels made these defects evident, and they have been remedied in all of the more recent profit sharing plans both in this country and in Great Britain. Thus the "Detroit Plan" and the "Washington Gas Rate Plan," although new in certain details, are based fundamentally on principles which have been tried and have been proved successful.

There is every reason to believe that other gas companies will find the adoption of similar profit sharing rate plans to be a desirable method of solving certain of their rate and public relations problems.

A New Era of Gas Advertising

ON December 3, 1935, we entered a new era of advertising gas and gas service. The first of a series of 104 cooperative radio broadcasts featuring "The Mystery Chef" was given on that day.

It is true that we have had aggressive advertising campaigns in the past. Also, various gas companies have sponsored radio programs. The significant feature is that we now have *a real cooperative effort.*

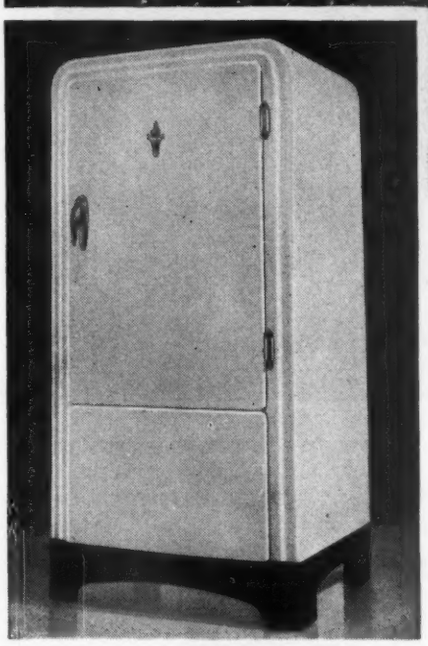
Competition has become so keen and the financial resources of our competitors so great that only by uniting in certain of our efforts, by utilizing the most modern methods and by employing the best skill and talent can we keep gas in the forefront where it belongs.

That the gas industry is keenly awake to the advantages of such cooperative effort is evidenced by the fact that companies supplying nearly 90 per cent of the customers in the area covered by the broadcasts are supporting the project. Of course, the cost is relatively low and the talent employed is the very best. This, however, is made possible by cooperation and by nothing else.

A cooperative advertising campaign in the magazines which reach the home is the next project for consideration. Letters have gone out inviting the support of the gas companies of the country. Do you have competition? Can you alone afford to advertise in the national magazines? You do not need to answer. We know that it is only by united cooperative effort that we can tell the story of gas nationally at a reasonable cost to each company. We know that to be the only way in which we can meet our competitors on an equal basis; and an equal basis of competition is all we ask to assure the future success of our industry.

The new era of gas advertising will be one of modern methods and cooperative effort. The cooperative radio program has been launched. The cooperative national advertising program should be launched at the earliest practicable date. They both deserve the fullest measure of support that you can give them.

ELECTROLUX IS THE OVERWHELMING FAVORITE AT NEW HAVEN



GAS REFRIGERATION goes into 1936 a favorite by big odds in New Haven. During the past ten months, New Haven gas men have carried Electrolux to sales leadership . . . outselling by far the nearest competitive make of automatic refrigeration. And that's *real* achievement in this home of the Elis, where battles are always hotly contested.

Results in the recent A. G. A. Prosperity Cup Contest also indicate the kind of mettle these New England gas men are made of! They came out *on top* for total installations per 10,000 meters in Division B.

Writes P. J. Naschold, sales manager of New Haven Gas Light Co.: "Our salesmen and salesladies entered into the spirit of this contest with vigor and enthusiasm. No special inducements were made to them, as they were eager to make a good showing and realized that with the stimulus of this splendid campaign more sales could be made, with resultant extra earnings. The effort which they put forth is attested to by the fact that they won five of the final individual awards in Division B, including first and second place.

Displays Produce Sales

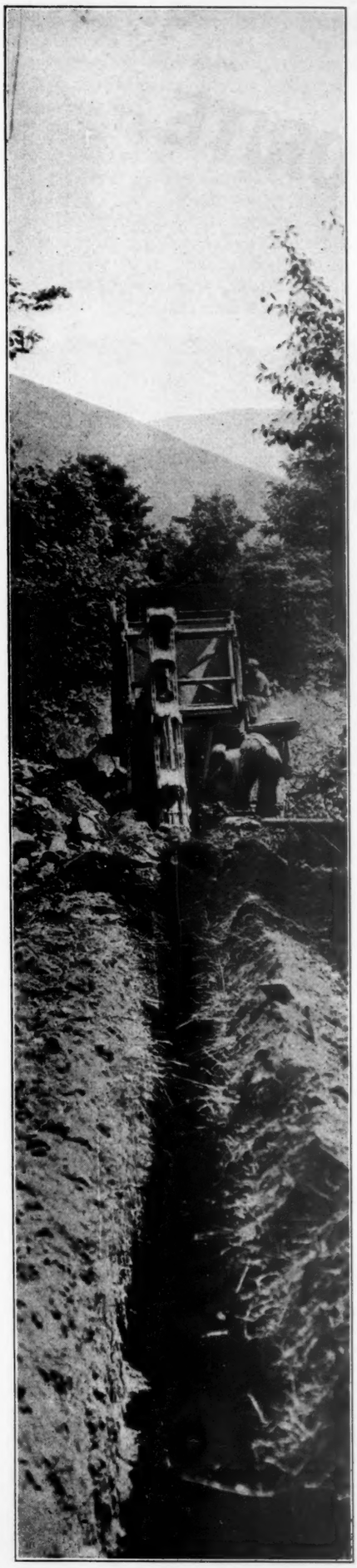
"We advertised liberally in our local papers and bent every effort to secure sales under our regular merchandising plan rather than by deep cut inducements. Displays of Electrolux were made in several of our dealers' shops. The home service department held demonstrations in cooperation with some of the known hardware stores. Our display at the Better Homes and Gardens show alone resulted in 140 direct sales."

Plan now for 1936

Throughout the coming year, gas refrigeration offers every gas company an unparalleled opportunity to increase the gas load, increase their sales people's earnings, increase the satisfaction and good will of customers with gas. Every Electrolux installed publicizes the modernity of gas as fuel . . . gives a strong impetus to the sale of other gas-using appliances.

Right now, plan to make gas refrigeration the spearhead of your 1936 merchandising and sales program. Take advantage of the ever-mounting popularity of gas refrigeration to win new successes for your company. Servel, Inc., Electrolux Refrigerator Sales Division, Evansville, Indiana.

NEW *Air-Cooled*
ELECTROLUX
THE SERVEL *Gas* REFRIGERATOR



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UNITED ENGINEERS & CONSTRUCTORS INC.

New York Philadelphia Chicago

MAXIMUM RETURN TO CLIENTS PER DOLLAR EXPENDED

DECEMBER
1935

AMERICAN GAS JOURNAL

VOLUME 143
No. 6

Industrial Furnace Atmospheres

By
C. George Segeler*

FOR a period of more than five years reports have appeared concerning special treatment of furnace atmospheres for various heating processes. At first these were confined to a few isolated experiments, but as the idea grew, devices were perfected for the production and control of the composition of such atmospheres, which were then specifically produced to meet specifications which were found to yield the best results on any particular product.

In part this work was undertaken by individual concerns with a specific problem to solve, but it has been supplemented by basic research carried out in leading university laboratories which have covered such subjects as the influence of atmospheres on steel, non-ferrous metals, effect of various gases on ceramic bodies, etc. Although such a program can never nearly be finished, it is clear that great strides have been made towards setting up the fundamentals that underlie the thermal treatment of the various products.

Just because of the variety of atmospheres and materials that are being treated in these special atmospheres, no comprehensive survey has been made of the satisfactory commercial methods now in use from the point of view of the chemist. It is evident that as the use of special gaseous atmospheres spreads, there will be a great need for practical methods of analysis and control which will require the services of a trained chemist. It seems appropriate, therefore, to summarize for the first time the state of the knowledge of the use of special industrial furnace atmospheres.

Popular conception had long ago divided industrial furnace atmospheres into three typical conditions: (1) neutral, (2) oxidizing, and (3) reducing.

Neutral Atmospheres

As conventionally defined, neutral atmospheres are those in which there is practically no oxygen which can be found with an Orsat apparatus, nor any substantial amounts of CO or other unburned combustible gas. Such an atmosphere can readily be obtained by adjustment of the air-fuel ratio, and with modern gas burner equipment such an adjustment can be maintained over a relatively wide range of turndown of hourly heat input.

The concept that such an atmosphere is neutral was soon shattered, for it is evident that at the elevated temperatures of most of the thermal processes, water vapor and carbon dioxide can both be strongly oxidizing. The reactions of these materials with steels of various kinds have been studied at considerable length, and it is certain that the old idea of a neutral atmosphere must be revised.

Truly neutral atmospheres can be produced by the use of absolutely pure, dry nitrogen, for example. On the other hand, commercial nitrogen contains sufficiently large quantities of oxygen and water vapor to be decidedly oxidizing in its effect.

Another idea of a neutral atmosphere is the completely muffled hearth. To be sure, during the heating-up process such an atmosphere is practically neutral because the small quantity of oxygen initially present cannot do a great deal of damage. In practice, however, it is nearly impossible to seal such a hearth in such a way that infiltration of air will not occur, and consequently the atmosphere must be regarded as oxidizing. A recent German shut furnace is designed to permit a partial vacuum to be maintained after heating up. This is claimed to prevent all surface injury and change.

Determination of Small Amounts of Oxygen

As a guide to investigators who want to analyze gases for small traces of oxygen, the following method may be of help.

The lower limit of positive detection of oxygen by the usual volumetric methods is about 0.2 per cent by volume.

The qualitative method used by Phillips and suggested by him as possible quantitative method has been satisfactorily used for the determination of oxygen in natural gas. The method, which is a modification of that of Winkler for the determination of dissolved oxygen in water, is based on the use of precipitated manganous hydroxide in water. Manganous hydroxide, which is white, absorbs oxygen readily and changes

* *Industrial Engineer, American Gas Association.*

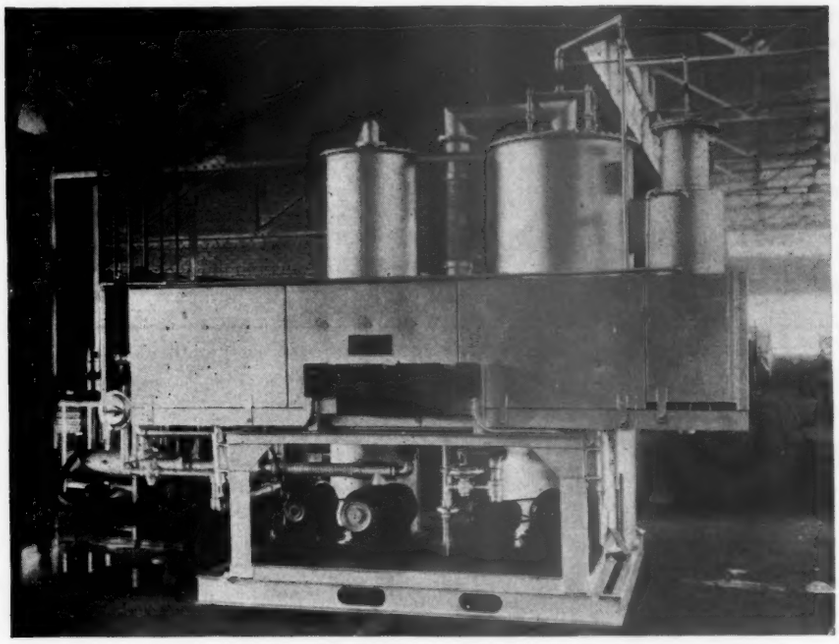


Fig. 1. Exterior view of a typical unit designed to produce special atmospheres from raw city gas. As indicated in the text, such atmospheres can be devised to produce a wide variety of specific conditions, making use of partial combustion, washing and refrigeration to remove various constituents in order to produce the desired final protective or process atmosphere.

to manganic hydroxide, which is brown. When a little potassium iodide solution and then sulfuric acid are added, the oxide of manganese dissolves and liberates iodine, which is recognizable by its color, even when only the most minute traces of oxygen are present. By means of a standard solution of sodium thiosulfate the free iodine may be determined.

The reactions taking place in the process and data required for the calculation follow:

$$MnCl_2 + 2NaOH = 2NaCl + Mn(OH)_2 \text{ (White)}$$

$$4Mn(OH)_2 + O_2 + 2H_2O = 4Mn((OH)_3 \text{ (Brown)}$$

$$2\,Mn(OH)_3 + 3H_2SO_4 + 2KI = 2MnSO_4 + K_2SO_4 + 2\,I \text{ (Red)}$$

$$2\,I + 2Na_2S_2O_3 = 2NaI + Na_2S_4O_6$$

Hence, 32 grams of oxygen are equivalent to 507.68 grams of iodine. In using N/40 sodium thiosulfate solution for the estimation of the liberated iodine, 1 cc of the solution is equivalent to 1.397 cc of oxygen measured at 0° C. and 760 mm pressure; or 1 cc of the solution is equivalent to 0.14 per cent of oxygen in a gas mixture, if only 100 cc of the sample is taken for the determination. If larger quantities of the sample are used, the delicacy of the test is much increased.

When large quantities of the sample are available for the test, bubble the gas mixture slowly through the solutions of sodium hydroxide and manganese chloride. The rate should not exceed 5 cc of gas per minute, and at least three bottles in series containing absorbing solution should be used to insure a quantitative test. Small Woulff bottles with three openings are convenient for making the absorption, as the middle opening can be fitted with a dropping funnel for admitting the sodium hydroxide after the absorption train has been purged of air.

Oxidizing Atmospheres

Although the presence of any excess air clearly brings an atmosphere into the so-called oxidizing class, the actual amount present is of considerable commercial importance. Certain operations require strongly oxidizing atmospheres, such as core baking, vitreous enameling and certain other ceramic work. Others may require a very small amount of oxygen, as for example the atmospheres tried for the prevention of decarburization and scaling in the hardening of tool steels.

It has been reported, for example, that the amount of scale has been reduced in certain gas fired tool steel heat treating operations but that the

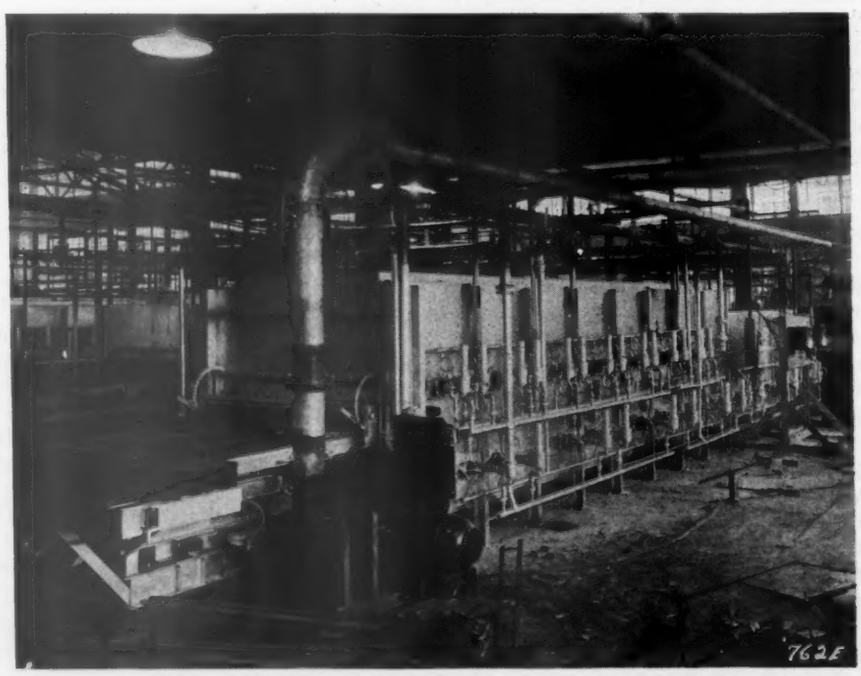


Fig. 2. Side view of a large gas-fired furnace used in the automobile industry for the making of spring leaves. The temperatures required are provided from suitable gas burners that can be seen along the side of the furnace while the protective and process atmospheres are supplied from a separate set of pipes feeding into the muffle chamber, through which the work is passing. Where necessary the atmospheres can be automatically cycled so as to provide the changing compositions required by a given process or over the length of the travel of the work.

thin film remaining could not readily be removed even by pickling. Some of the coal furnaces used for this work actually gave better results. This has been attributed by some workers to the ease with which a more strongly oxidized surface can be cleaned off. The scale removes easily on pickling leaving a surface in which there is no decarburization. The gases which might have caused decarburization may not have been able to work through the scale layer.

As has already been indicated, in some cases the atmosphere is only protective in nature, whereas in others it enters actively into the chemistry of the production of the product in question. The core baking reference is an example of the latter, for here the oxygen is required for the vigorous oxidizing of the linseed oil so that the binder may be properly baked and the core may possess sufficient mechanical strength and surface hardness.

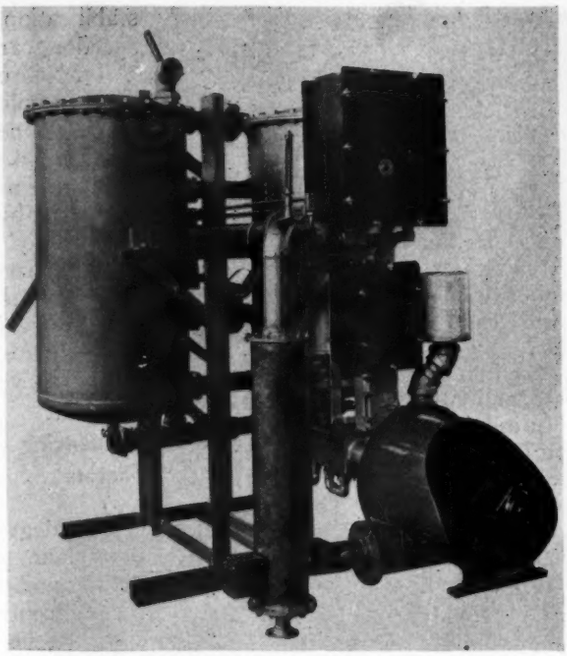


Fig. 3. Silica Gel dehydrator used for drying special atmospheres in a Swindell-Dressler kiln operating in the United States Steel Corporation plant at Gary, Indiana.

Reducing Atmospheres

Reducing atmospheres also have widely varying characteristics, depending upon the reducing agent, its amount and the function of the atmosphere. In the case of the application of natural gas to the production of zinc, for example, or the reduction of tungsten oxide by hydrogen, the maximum reducing effect is desired. As a general rule, however, mildly reducing atmospheres have been used for heat treating operations as a protection against excessive scaling. Upthegrove has observed that atmospheres at any given temperature and for any given steel become strictly non-scaling only when the ratios of water vapor to hydrogen, and carbon dioxide to carbon monoxide, are reduced to certain limiting values, so it is not proper to draw the conclusion that reducing atmospheres mean freedom either from scaling or from other undesirable effects such as decarburization. However, it is general practice to use small amounts (1 to 3 percent) of carbon monoxide in the furnace atmospheres to keep scaling at heat treating temperatures to a minimum. Of course, at forging temperatures the situation is altered. Essentially, this is simply an application of well-established chemical principles, that the reaction rates tend to rise with increasing temperatures, and therefore at temperatures in the forging range, gas must be burned with a very appreciable excess of fuel if the scaling occurring in an atmosphere obtained by complete combustion is to be reduced by one-half.

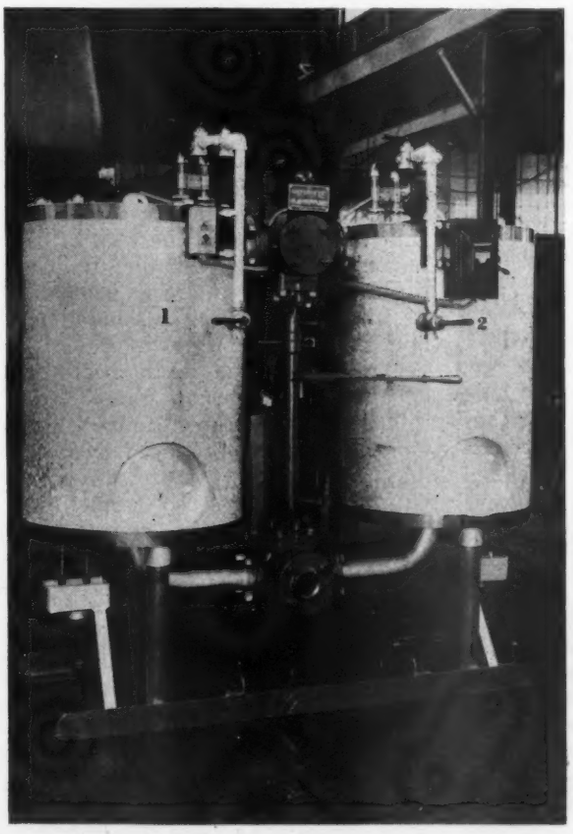


Fig. 4. A second type of dehydrator employing activated alumina designed for gas drying in connection with controlled furnace atmospheres. In some cases these dryers have been adapted to hold the controlled furnace atmospheres to a dew point below minus 60°C.

The reactions between steel and the combustion products are given by Gillett.* These reactions are complicated enough in themselves, but when the heat treatment of alloys is considered, they are further complicated by the presence of the alloying elements.

No reaction

$N_2 + Fe$
$H_2 + Fe$
$N_2 + Fe_3C$
$CH_4 + Fe_3C$
$CO + Fe_3C$

Oxidizing

$O_2 + 2\,Fe \leftrightarrows 2FeO$
$CO_2 + Fe \leftrightarrows FeO + CO$
$H_2O + Fe \leftrightarrows FeO + H_2$
$CO_2 + Fe_3C \leftrightarrows 3\,Fe + 2\,CO$

* *Metals & Alloys, Aug., 1935.*

Carburizing

$$CH_4 + 3\ Fe \leftrightarrows Fe_3C + H_2$$
$$2\ CO + 3\ Fe \leftrightarrows Fe_3C + CO_2$$

Decarburizing

$$2\ H_2 + Fe_3C \leftrightarrows 3\ Fe + CH_4$$
$$O_2 + 2\ Fe_3C \leftrightarrows 6\ Fe + 2\ CO$$

The addition of alloys to the iron and carbon will greatly enlarge the number of possible reactions, so that this list cannot be taken as complete, but merely as illustrative of the difference in behavior between the various combinations of materials present in industrial furnaces, depending upon the particular circumstances of time, temperature and concentration which are involved. The possibility of catalyzing effects, especially the reactions favored by the presence of moisture, need to be considered in practice.

The combustion products themselves can interact in accordance with the well known equations given below.

$$2\ H_2 + O_2 \leftrightarrows 2\ H_2O$$
$$2\ CO + O_2 \leftrightarrows 2\ CO_2$$
$$CH_4 + H_2O \leftrightarrows CO + 3\ H_2$$
$$2\ CO \leftrightarrows CO_2 + C$$
$$CO_2 + H_2 \leftrightarrows CO + H_2O$$
$$CH_4 \leftrightarrows C + 2\ H_2$$
$$N_2 + O_2 \leftrightarrows 2\ NO$$
$$2\ NO + O_2 \leftrightarrows 2\ NO_2$$

The first two equations show the ordinary dissociation equations for water vapor and carbon dioxide and occur in all combustion reactions, particularly at elevated temperatures. The equilibrium values for various partial pressures are available.† The fourth equation is more frequently considered in its reverse aspect, but in the presence of heated iron oxide, carbon monoxide can decompose as indicated. The fifth equation is the well known water gas reaction, the constants for which are given in the reference just cited. This, as well as the reactions showing the simple cracking of methane, are distinctly catalyzed by the presence of hot iron oxides.

In all of these as well as the preceding reactions, temperature and partial pressure have a very important bearing. For example, it was formerly thought that carburizing by means of unburned gas was speeded up by increasing the partial pressures of the carbon-bearing constituents. This has now been shown to be more or less in error, and this particular effect is attributed to the probable stabilization of the hydrocarbons speeding carbon diffusion rather than a function of pressure directly. The very complexity of this situation illustrates the need for additional research and study in this field. The chemistry of the individual reactions is simple, but the results of complex mixtures of individual constituents at varying partial pressures in contact with a variety of heated substances, many of which have catalytic effects, are neither simple nor thoroughly explored as yet.

†*Combustion, Third Edition. Pub. by American Gas Association, New York.*

Influencing Factors

The degree to which these reactions take place is influenced by a great number of factors. Not only the concentrations of the constituents, but the equilibrium ratios are of considerable significance. The A.G.A. research has shown that rate of flow of gases, temperature and composition of the steel are also factors which must be considered. Pressure has been mentioned as a possible influence, and although this affects equilibria, taken by itself it does not appear to be as significant a factor as was at one time thought to be the case.

A more detailed study of the influence of atmospheres on steels will show that in addition to the obvious factors already mentioned, there are others rather removed from the control of the immediate user of the steel which will affect the results. That is to say, the melting practice has been found to affect scaling; the grain size, as is to be expected, has been shown to influence the rate of decarburization. A number of these points were first brought out by the American Gas Association research, but they have not yet been completely investigated to the extent that a positive conclusion can be drawn. In any event, it must be obvious that the interactions between furnace atmospheres and steels cannot be predicted from the chemical analysis of either steel or atmosphere. The oxidation of the iron leads to scaling; the oxidation of the carbon, whether through reaction with oxygen or through reaction of iron carbide and hydrogen to form methane, leads to decarburization. These reactions and the rate at which carbon can diffuse into or out of steel form the basic changes with which the chemist will have to deal in connection with furnace atmospheres.

Controlled Atmospheres

Although a great deal of the material which has just been given is typical of the problems of the steel industry, the use of controlled furnace atmospheres is not at all confined to that work. In fact, it is the purpose of this paper to summarize the recommendations with regard to furnace atmospheres on other types of heating operations as well as steel.

From the chemical viewpoint, the first consideration is the production of the atmosphere itself. For some processes, the adjustment of dampers and burner valves can be used to produce the desired atmospheres. These must, of course, be checked by suitable analysis to see that they are within the desired limits, but to a large degree these atmospheres can be duplicated by readjusting the burners and dampers to the same setting. Nevertheless, rather frequent checks should be made of the atmospheres to see that the settings have remained undisturbed. Furthermore, there is ample room for study and research even in this relatively simple field. It has been reported, for example, that small quantities of sulfur dioxide will markedly increase the oxidizing tendency of given atmospheres. Further investigation of this point might disclose the desirability of removal of sulfur, as has been done in the case of the atmosphere used for glass annealing.*

Not only are combustion atmospheres useful, but in many instances the unburned gas can be advantageously applied. Carburizing has long been carried on with raw gas, and recently considerable impetus has been given to this by experimental evidence that moisture is apt to be a controlling factor in the rate of carburizing. The gas blanket under a diffusion flame used for protection of forgings has been another development of recent times in which the versatility of gas as a protective agent has been demonstrated.

The second type of controlled atmosphere is that produced by utilizing cylinders of compressed gases. Unfortunately, gases from such sources are relatively high priced, and consequently only a limited application exists for this type of atmosphere.

Gases obtained from cylinders are generally found to contain small quantities of impurities. While these may be insignificant for many applications, they are apt to be of considerable importance when the gases are

**Metals & Alloys, Aug. and Sept., 1935.*

(Continued on page 45)

Beginning a New Series of Articles By Erick Larson

Regulator Structures

PART I

Classification of Pits

Pit entrance surrounded on three sides by bushes and grass which may conceal potential hazards.

Raised Pit. Cover arranged to give practically full openings. For safety cover is triple hinged. Wood top sloped to shed rain.

THE necessity for a structure to enclose a line regulator is dependent upon climatic conditions. In mild sections, regulators have been installed without protection from the elements except for occasional boxing-in to shade them from the direct rays of the sun. Such slight protection is usually constructed without detailed plans or specifications, although it is desirable to sectionalize the structure for ease in disassembling.

A sub-surface room or pit is the most common method of enclosing a regulator. In this discussion a pit will be considered to be any structure having its top flush with, slightly above or below the ground level.

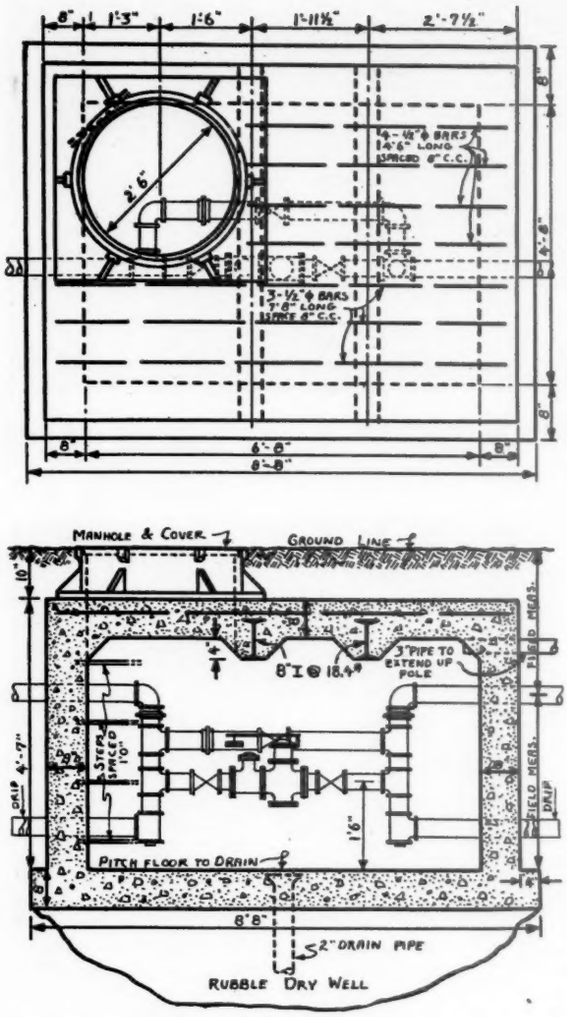
A regulator house is a structure having at least one full story above ground. It may have a cellar or basement but such design is uncommon as the majority of high pressure controls are installed where the land value does not warrant the construction of basements. For safety and convenience it is preferable to have all regulator equipment on the first floor or ground level.

A combination consisting of a shallow pit and a low-roofed house is sometimes used. For appearance, convenience and safety, however, it is preferable to construct either a house or pit. The low-roof house or raised pit design usually results from a desire to install the regulator at the existing main level so as to avoid lowering and trapping the main. When orifice meters are installed in connection with regulators and space is at a premium, maintaining the piping to regulators at the original level is advantageous; but even in such cases the installation of the required bends may be a negligible factor compared with the advantages of a regulator house entirely above ground.

The use of unoccupied sections of existing structures for the housing of regulators is not uncommon. A disadvantage is that ordinarily a standard design can not be followed as the regulator must be fitted to the unoccupied section. It is usually difficult to isolate regulators from hot types of foggers or other gas equipment in an existing building and segregation is advisable for safe practice.

In rural and suburban territories it may be necessary to extend safety considerations to the area adjacent to a pit or house. Bushes or trees, particularly those having thorns, growing close to a pit may scratch a person entering or leaving the structure. Eye injuries from such sources may be severe. Trimming or removal of the bushes or trees is advisable, though permission must often be secured from abutting owners. High grass may conceal tin cans, broken glass, boards with protruding nails or other potential sources of injury. A sufficient area about the pit planted with grass seed or sodded improves appearances and adds to safety.

Continuity of service as an essential safety feature is often considered as justifying the installation of two regulators in parallel, especially when the system has only one source of supply. Protection against excessive pressures on a system is sometimes furnished by regulators in tandem. In both cases two or more regulators are required, and



Standard Design used by one utility for roadway pits. Projections below ceiling of pit not recommended. Manhole frame rests upon pit and is not part of roof. Effectiveness of drain increased by placing rubble underneath bottom.

the most common practice is to place them in one structure. As a safety feature by-pass valves are usually provided. These should be accessible from outside of the structure so that service may be continuous even though regulators must be valved off and the structure cannot be entered.

Wood as a material for constructing pits, houses, partitions or other major portions of regulator structures should not be included in any section. It has many obvious objections besides increasing the fire hazard particularly after it has become impregnated with oil or gas.

Classification of Pits

Pits are not subject to general classification although in the standard practices of various companies they are designated by shape, construction material, location or size.

Shape

The usual shapes are rectangular, round and oblong. The rectangular types simplify form construction on concrete pits and brick laying on brick pits. A rectangular pit equal in length and width to a round or oblong type provides increased working room due to the extra space in each corner. The additional material required for rectangular construction is often a small factor in the total cost.

Round pits are ordinarily confined to the smaller sizes where the manhole frame may be placed directly on the side walls with little or no tapering of the walls. Such practice eliminates the need for manhole frame supporting beams. Small brick pits are often rounded for economy of material and because of the relative ease with which a bricklayer can construct them.

Oblong pits are seldom constructed of brick or concrete but are generally restricted to those made up from cast iron sections. An advantage sometimes claimed for round or oblong pits is less possibility of gas pocketing in corners. This is based on a much disputed contention that gas will stratify or confine itself to certain portions of a structure.

Ventilation is improved in pits when the roof is dome-shaped as the air in the pit can circulate to all parts more readily than where the roof is flat.

Construction Material

Concrete is the most common material used for the construction of regulator pits in the gas industry. The design and construction of concrete pits should follow the best reinforced concrete practices. For sides and bottom an excellent practice is to use a mixture in the proportion of 1:3:6 of cement, sand and stone respectively. The roof mixture is usually enriched to a proportion of 1:2:4.

In the design and selection of the roof mixture proportions it is advisable to consult the highway department officials within the particular political division where the pit is to be constructed. Their preferences or rulings on concrete mixtures for roadwork or for similar structures will naturally be given due consideration.

The use of cements that attain their full strength rapidly is becoming common for pit construction. No material to accelerate setting should be used with cements which attain practically full strength within 24 to 48 hours. Cements quickly attaining full strength are distinctly different than cements having a flash set or those in which the set occurs within a few minutes after the mixing has ceased. Most flash setting cements do not secure their full strength more rapidly than ordinary cements.

When selecting early full strength cements for wearing surfaces care should be exercised to secure those which do not erode rapidly under traffic. Local highway officials usually have specifications for early strength cements which restricts selection to a few manufacturers whose product has been proved by experience.

The cost of high early strength cements may add a small proportion to the total cost. The additional material cost is often more than offset by a saving in labor particularly where watchmen must be employed to guard the construction work during periods when work is not in progress. Omitting the consideration of a watchman, economy frequently results from the rapidity of curing which eliminates the maintenance of lanterns and barricades during long curing periods. With the use of high early strength cements, the forms may be removed the day following pouring and regular work may proceed without more than the usual precautions against damage to the new concrete. A decrease in the total time required for pit construction is advantageous in foster-

ing good public relations as the period during which the construction area is closed to traffic is substantially reduced. Regardless of the interference with traffic, the effect of construction work executed with dispatch leaves the impression with lay observers that such work was well planned and executed.

Water Proofing

Concrete pits may be sub-divided into two classifications, plain and water-proofed. Some water proof all pits as a precaution against breakage in water, sewer, or drain lines; but ordinarily pits are not water-proofed unless they are partially submerged for at least part of the year, or ground waters occasionally rise above the pit bottom.

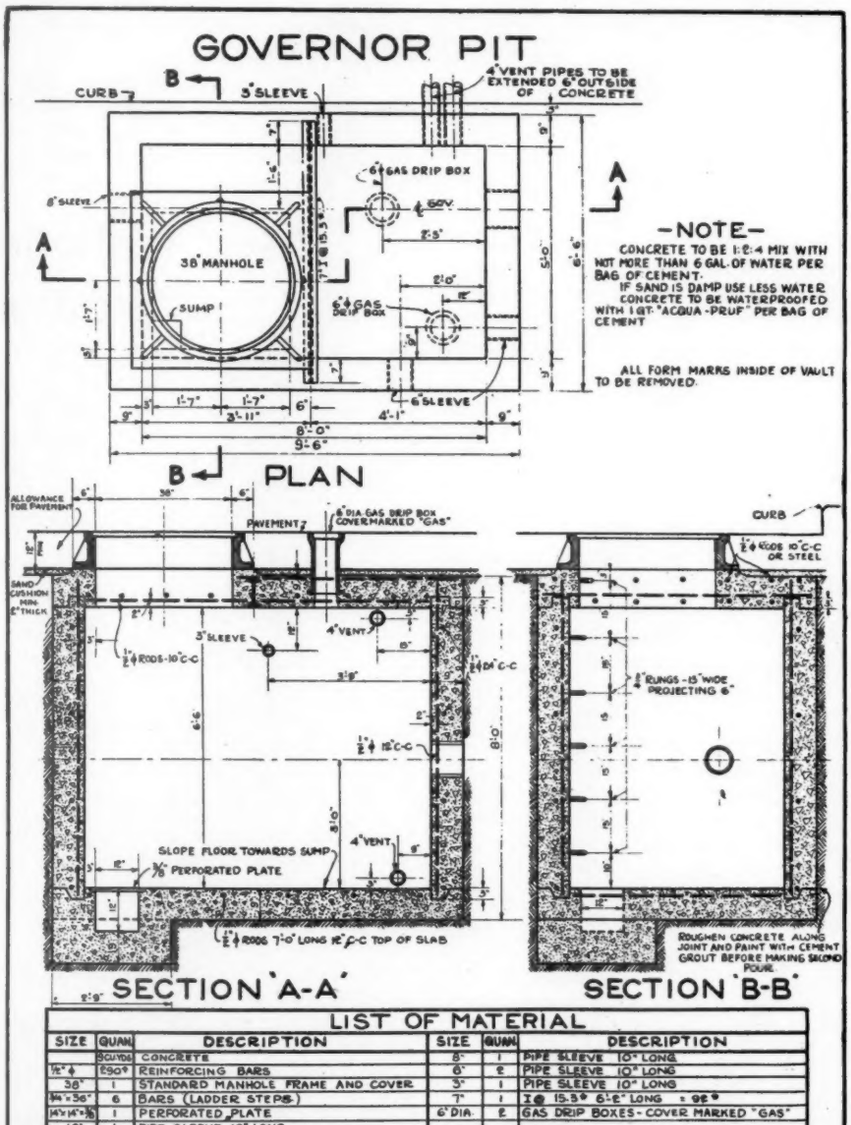
There are three types of water-proofing. Integral water-proofing is produced by mixing special materials with the concrete ingredients. These tend to make the concrete impermeable. Integral water-proofing has been used where the concrete was subsequently to be subjected continuously to at least 20 pounds per square inch hydrostatic pressure, and it was desired that there be no evidence of moisture on the inner surface. The difficulty experienced with integral water-proofing is the production of a uniform mixture of the aggregates. The water-proofing material has a tendency to segregate, and mixing for a greater length of time than usual is necessary to counteract the tendency. Tests by Federal agencies show that certain types of integral water-proofing materials actually assist in maintaining a uniform density and others will increase the ease of pouring the concrete. In selecting the water-proofing, investigation should be made to determine the nature of the mixture and the chemical used, as many of the trade-marked water-proofing materials may be secured less expensively by specifying the chemical terminology.

The other two types of water-proofing may be generally classed as membrane water-proofing. The exact classification derives its name from the position of the water-proofing materials. This is either surface or internal. Surface water-proofing may be applied on the outer or inner surfaces of the concrete. Internal water-proofing is accomplished by constructing a concrete shell, placing the membrane and adding concrete until the structure has the required internal dimensions.

Surface water-proofing is usually placed on the outside wall so that any hydrostatic or other pressure existing around the structure will assist in keeping the water-proofing against the face of the structure. This factor is an important one in maintaining an impervious seal for a long period of time, but the application is difficult. It is impractical to apply outside surface water-proofing until the concrete forms are removed. To secure really satisfactory water-proofing, the surface of the concrete must be dry at the time of application. It is impractical to use this type of water-proofing on the bottom of a structure. When surface water-proofing is placed on the sides of a structure it should be made integral or continuous with the bottom water-proofing to prevent water seeping through any crevices. This necessitates the construction of a false bottom followed by the water-proofing which may be continued up the outer vertical wall surfaces after completion of the walls.

Fewer construction difficulties are encountered when water-proofing is applied to the inside surface of a structure; but this method is not recommended as moisture penetrating the walls will accumulate between the surface of the concrete and the water-proofing material, gradually forcing the water-proofing material away from the concrete surface. This eventually results in failure of the water-proofing. The thickness of walls and floor between water-proofing and the pit interior should equal or exceed the outer shell thickness.

Installing water-proofing internally in the walls and floors adds considerably to the cost as it is necessary practically to construct two pits. However, if membrane water-proofing is selected, the internal method carefully installed is the most preferable and will last indefinitely.


GOVERNOR PIT
CURB
B
5" SLEEVE
4" VENT PIPES TO BE EXTENDED 6" OUTSIDE OF CONCRETE
6" GAS DRIP BOX
8" SLEEVE
36" MANHOLE
SUMP
A
-NOTE-
CONCRETE TO BE 1:2:4 MIX WITH NOT MORE THAN 6 GAL. OF WATER PER BAG OF CEMENT.
IF SAND IS DAMP USE LESS WATER
CONCRETE TO BE WATERPROOFED WITH 1 QT. "ACQUA-PRUF" PER BAG OF CEMENT
ALL FORM MARKS INSIDE OF VAULT TO BE REMOVED
6" SLEEVE
B PLAN
ALLOWANCE FOR PAVEMENT
PAVEMENT
6" DIA. GAS DRIP BOX COVER MARKED "GAS"
CURB
SAND CUSHION MIN. 6" THICK
4" VENT
RODS 10" C-C OR STEEL
RODS - 10" C-C
RUNGS - 15" WIDE PROJECTING 6"
SLOPE FLOOR TOWARDS SUMP
PERFORATED PLATE
RODS 7'-0" LONG 12" C-C TOP OF SLAB
ROUGHEN CONCRETE ALONG JOINT AND PAINT WITH CEMENT GROUT BEFORE MAKING SECOND POUR.
SECTION A-A
SECTION B-B

LIST OF MATERIAL

SIZE	QUAN.	DESCRIPTION	SIZE	QUAN.	DESCRIPTION
	8 CU YDS.	CONCRETE	8"	1	PIPE SLEEVE 10" LONG
½" ϕ	690#	REINFORCING BARS	6"	2	PIPE SLEEVE 10" LONG
36"	1	STANDARD MANHOLE FRAME AND COVER	5"	1	PIPE SLEEVE 10" LONG
¾" × 36"	6	BARS (LADDER STEPS)	7"	1	I @ 15.5# 6'-2" LONG = 98#
14" × 14" × ⅜"	1	PERFORATED PLATE	6" DIA.	2	GAS DRIP BOXES - COVER MARKED "GAS"
10"	1	PIPE SLEEVE 10" LONG			

Note vent openings at top and bottom of pit. Sand cushion placed between pavement and roof top. Sump directly under manhole frame for convenience in pumping pit dry. Valve boxes placed directly above valve locations in pit to allow operating valves from outside of pit.

The cost of a membrane waterproofed pit will exceed considerably one in which the integral method is used. The integral method is the most common due to economy of construction, but in exceptionally difficult conditions the membrane types will ordinarily give superior protection if properly installed.

Water-proofing is not always confined to locations where the water table may rise above the bottom level of the pit. It is also frequently used where the ground moisture would gradually seep through the walls, causing the inside surfaces to become damp and slimy. For safety reasons it is desirable to prevent a slimy condition, and this may be economically accomplished by the integral types of water-proofing.

Telephone and electric utilities require numerous pits, but the purpose of such pits is somewhat different than in the gas industry. Other utilities usually have apparatus in the pits which has no moving parts and, therefore, pits are not entered as frequently as those containing regulators.

Brick Pits

Brick pits usually require less investment than other types. A brick pit also has the advantage that changes may be made easily and economically whenever they become necessary because of alterations in road grade or surface. The brick used is generally the best grade of non-ornamental brick, and the mortar commonly is a 1:1 mix of cement and sand.

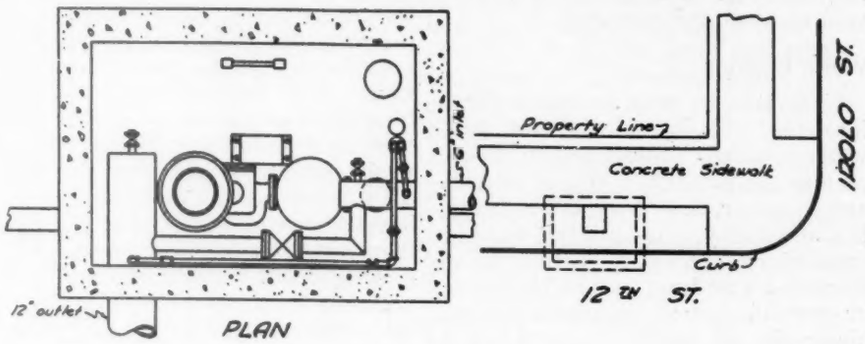
Brick walls are usually a minimum of 8 inches in thickness or one single length of brick. When it is desirable to construct a water-proof pit of the membraneous type it is sometimes more economical to construct the outer shell of brick and smooth the inner surface with cement to avoid damaging the tar paper or felt due to unevenness of the foundation or backing.

Most utilities construct the brick pit so that the manhole frame will fit directly on the side walls. If necessary the brick work may be tapered slightly near the pit top so as to reduce the top dimensions to that of the manhole frame. In gas practice full headroom is desirable; and to eliminate tapering, a common practice is to construct the top of the brick pit of concrete.

Where the soil surrounding a pit is frequently or continually damp or ground waters rise above the bottom of the pit, the porous nature of brick results in a damp pit. It has been noted that many brick pits surrounded by slightly damp soil have a coating of slime over the inner surface, and this is undesirable when the pits are frequently used.

As brick work, particularly in a round pit, can not be laid with an absolutely smooth interior surface, facing the interior with a layer of cement will improve appearances, illumination, cleanliness and safety.

Concrete blocks have been used for brick pits but usually are considered as lacking in sufficient strength and resistance to abrasion. The interior of pits are subject to damage from tools but the possible damage from that source to concrete or brick is comparatively small. The porosity of concrete blocks and difficulty of securing tight joints are disadvantages.



Typical Governor Installation

Brick or concrete blocks are sometimes used for one or two sides of a pit when there is probability that additional space will be required in the future.

(Continued on page 43)

Three National Gas Appliance Campaigns for 1936

THE Commercial Section of the American Gas Association is arranging three rousing sales contests and campaigns to stimulate the sale of gas appliances during 1936, according to a recent announcement by C. E. Bennett, Chairman.

THE REFRIGERATION COMMITTEE will again hold its annual sales contest during the full three months period of April, May, and June. Profiting from experience gained in previous contests, the 1936 activity will be bigger and better than any previously held.

THE RANGE COMMITTEE will hold its contest during the six months of February 1 to July 30. Each registered company will select two months (not necessarily consecutive) of this period for an intensive campaign of modern gas ranges, and company prizes will be awarded for the best two months showings and, also, for the best showings made during the entire six months period.

THE WATER HEATING COMMITTEE will hold its first national sales contest during the eight months period beginning February 1 and ending September 30. Each registered company will select two months (not necessarily consecutive) of this period for intensive promotion of automatic water heater sales, and company prizes will be awarded to the best showings during the two months period and also for the entire eight months period.

A comprehensive series of monthly prizes is being arranged for the ranking individual salesmen in each of these contests and for those salesmen making the best showings during the entire contest. The bulk of the cash awards in each contest will go directly to these men on the firing line so as to insure their best efforts throughout these campaigns. Each activity is designed to stimulate the sales of cooperating dealers.

You will see from the above that these contests have been coordinated and scheduled so as to permit any operating company to participate in all three activities. Complete details of the Range and Water Heating Contests will be distributed during the last week in December, and the prospectus of the Refrigeration activity will follow about March 1.

"The Mystery Chef" Broadcasts Begin

Cooperative Advertising Campaign of Eastern Gas Companies Employs Modern Methods

THE gas companies in New England and the Middle Atlantic States during the present month are launching the first cooperative radio broadcasting campaign ever undertaken in our industry. "The Mystery Chef," one of radio's most unique and popular characters, will be the sole talent featured. His experience and ability makes him peculiarly qualified to advertise and popularize gas service. The success of the project seems assured in advance.

Thirteen radio stations will participate in the broadcasts. The schedule will be as follows:

Wednesdays and Fridays—10:30 to 10:45 A. M., beginning Wednesday, December 4, over the following stations:

WEAF—New York.
WEEI—Boston.
WTIC—Hartford.
WJAR—Providence.
WTAG—Worcester.
WCSH—Portland.
KYW—Worcester.
WFBR—Baltimore.
WRC—Washington.
WGY—Schenectady.
WBEN—Buffalo.

Tuesdays and Thursdays (by electrical transcription) beginning Tuesday, December 3, over the following stations:

WSYR—Syracuse (8:45 to 9:00 A. M.)

WHAM — Rochester (9:45 to 10.00 A. M.)

Arrangements can be made to include additional stations if there is a real demand from companies located in other parts of the country. Meanwhile companies outside of the broadcasting area may obtain electrical transcription records of "The Mystery Chef's" talks at a fee based on the number of domestic customers served. All inquiries should be addressed to "Regional Advertisers, Inc., 420 Lexington Avenue, New York."

Support for the broadcasts has exceeded expectations. In the area to be covered there are approximately 6,000,000 domestic gas customers. To date, companies serving 5,302,000 or nearly 90 per cent of these have participated in underwriting the project. Companies not included in the list of original underwriters still have the opportunity of signing up and of securing copies of "The Mystery Chef's" recipe book for distribution. However the terms probably will be somewhat less favorable than those obtained by the original participants.

The 100-page recipe book, entitled "Be An Artist at the Gas Range," is an integral and inseparable part of the whole project. These recipe books will be offered free by participating companies to customers who request them. They will serve two purposes. First, they will be a barometer of customer interest in the programs. Second, they should be a builder of good will, an effective medium for publicizing gas and a means of bringing the customers into closer contact with the gas company.

The distribution of the recipe book and its contents will be restricted to those companies which support the broadcasts, except that it may be used by Regional Advertisers, Inc., to aid or extend the broadcasting program. Presumably those companies outside of the regular broadcasting area who obtain electrical transcription records will also be eligible to secure the recipe book.

The cost of the project will not exceed 2½ cents per meter per year to the original participants. This covers 104 fifteen minute broadcasts extending over a period of one year, but does not include the cost of the recipe book. The recipe book will cost 4 cents per copy and participating companies agree to purchase a number equal to at least 5 per cent of their domestic customers. It is not proposed to make any profit on the enterprise and any funds remaining after all expenses are paid will be returned to participating members.

Regional Advertisers, Inc., has been mentioned in connection with these broadcasts. This is a New York corporation formed for the sole purpose of handling this project. Its

directors are the members of the previously existing Committee on Radio. Regional Advertisers, Inc., will work in close cooperation with the American Gas Association but the two organizations are entirely independent of one another.

Thus far we have said little about "The Mystery Chef," upon whose ability and personality the success of the whole project depends. To the public he is a man of mystery. Although unseen and unknown to his listeners he has nevertheless been more successful than any other living person in taking the mystery out of cooking and in helping to make it a pleasure and an art. To those who have worked with him on the organization and in the preparation for these broadcasts Mr. John Macpherson is no man of mystery. He has come rather to be a trusted friend whose unselfish cooperation has had much to do with the fact that the broadcasts are starting no later than December 3 and 4 under the most auspicious circumstances.

Corner of palatial living room of the "Mystery Chef" showing a combination modern gas range and refrigerator.

Tentative Approval Requirements for Gas Hair Dryers Completed By A.G.A. Committee

SPEEDING the initial formulation of requirements for the testing and approval of the newest variety of commercial gas appliance, the gas hair dryer, the American Gas Association, through its Subcommittee on Approval Requirements for Gas Hair Dryers, on October 14, completed the first draft of proposed specifications for this recently developed type of equipment. Meeting at the Palmer House, Chicago, in connection with the Seventeenth Annual Convention of the American Gas Association, the subcommittee prepared for first submittal to the criticism and comment of the entire gas industry the most complete initial set of suggested requirements yet developed without precedent for a new type of complete gas-burning appliance. This it was able to do working from (1) over ten years of experience on the part of American Gas Association committees in developing standards for 27 other varieties of gas appliances and their accessories, and (2) the results of nearly a year's thorough research on marketed gas hair drying units by the expert technicians of the A. G. A. Testing Laboratories in Cleveland and Los Angeles.

N. J. Reiff, Appliance Laboratory, United-Gas Improvement Company, is chairman of the subcommittee. Nine other authorities in the field are members.

Already the proposed standards have been printed in tentative form and distributed for comment to some 1,000 member companies of the American Gas Association, as well as to numerous interested national groups and bodies outside of the Association. When replies have been received the subcommittee will review its requirements in the light of comments submitted and, if no further research or investigation is necessitated, submit the revised standards to the American Gas Association Approval Requirements Committee (American Standards Association Sectional Committee, Project Z21) for final endorsement at the Spring, 1936, meeting. If approved, the requirements will be offered to the American Standards Association for approval as American Standard and will become effective on and after January 1, 1937.

As they now stand, the tentative gas hair dryer specifications require automatic gas control associated with the blower or fan in addition to individual burner valves and a manual main control valve. They also limit outlet air temperatures to 100 degrees Fahrenheit and require the use of gas pressure regulators, thermostats, and safety pilots. No stone is left unturned from the standpoint of safety. Other clauses included are essential from standpoints of service and design. High efficiency of performance is demanded; ample hot air supplies and even distributions of heated air to different helmets are specified; and both flue outlet temperatures and appliance surface temperatures after long operation are limited.

The importance of this action of the American Gas Association towards developing hair dryer standards is emphasized by the fact that, as a result of demands from the industry during the past year, a number of gas hair dryers have already been tested by the Association's Laboratories in accordance with the American Standard Approval Requirements for Gas Space Heaters and Unit Heaters and temporary approval extended to some half dozen such units on this basis. Hair drying by gas seems to be earning increasing favor throughout the country, and sizable new extensions of the commercial gas load appear to be in the offing as a result thereof. This new application of gas permits, it has been shown, a considerable saving in energy costs to operators of beauty and barber shops.

Customers' Accounting System—Public Service Electric and Gas Company*

John L. Conover

Assistant General Auditor, Gas Department, Public Service Electric and Gas Company, Newark, New Jersey

THIS report is a supplement to a similar report prepared for the Accounting Section in 1925, entitled "Customers' Accounting System—Public Service Electric and Gas Company," which presented in detail the application of machines to customers' billing, and described all phases of the customers' accounting procedure of the company. This latter report is printed in the 1925 Proceedings of the American Gas Association.

The substitution of National billing machines in Public Service Electric and Gas Company for the former make of mechanical billing equipment did not necessitate any changes in the existing customers' accounting procedure. However, the new billing machines do permit certain efficiencies and economies, particularly in the preparation and proof of the bills.

Territory Served

Public Service Electric and Gas Company serves that part of New Jersey extending from the northeastern boundary line of the State to the territory south of Camden—a distance of over 100 miles. Included in this territory are 222 municipalities served with electricity and 216 municipalities served with gas.

The company has on its lines approximately 1,000,000 customers, served through approximately 950,000 electric meters and 760,000 gas meters.

In addition to the general offices of the company, there are 27 commercial offices located throughout the territory. These offices are responsible for all phases of customers' accounting except the preparation of the bills.

Stub Plan of Accounting

The stub plan of customers' accounting is used, and each phase of the work is distributed evenly during the month. The accounts of each commercial office are divided into 21 routes. Each route is subdivided into units, the meters in each unit representing a full day's work for each meter reader. The meters in each unit are further classified as to street and house number. The four classifications thus obtained, namely, route, unit, street, and house number, form the account number used throughout the system for identification purposes. The meter reading records for the meters in each unit are bound together to form a meter reading book.

The billing of all electric lighting and gas accounts is done at the central billing department, located at the general office in Newark. The completed bills are sent from the central billing department to the commercial offices and are delivered, or mailed, from the commercial offices.

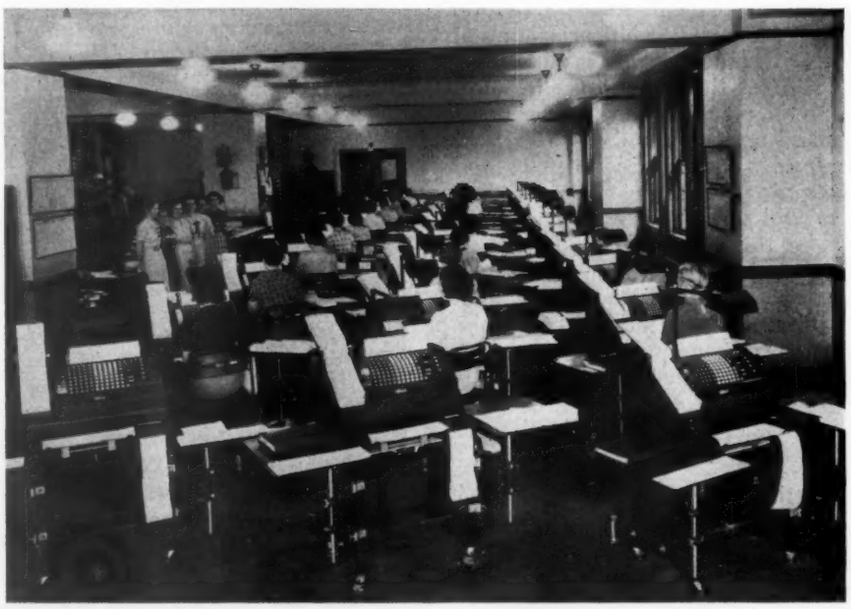
The Customer's Bill

The customer's bill is divided into four parts, as follows:

1. Ledger Record—This is used as the commercial office accounting medium.
2. Customer's Copy—This is retained by the customer.
3. Cashier's Coupon—This is returned to the company with the payment and is used as the basis for crediting the account.
4. Representative's Coupon—This is used by the company's representatives to assist in obtaining prompt payment.

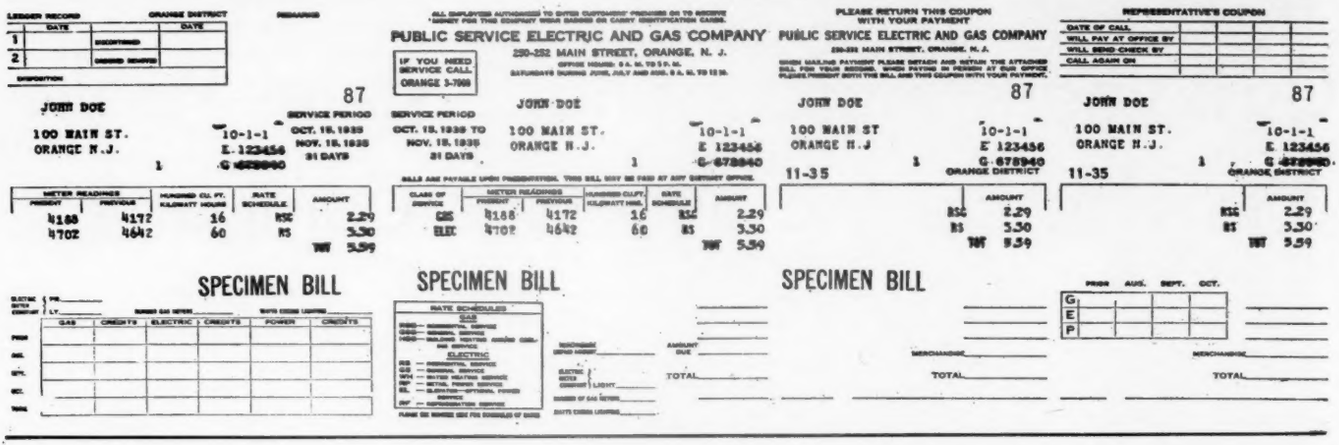
Meter Reading

The meters are read during the first 21 full working days of the month. The meter readers, in addition to recording the current month's index, both gas and electric, on the meter reading records, also make the subtraction and record the consumption. A comparison is made with the previous month's consumption and if necessary the readings are verified.



Billing machine division—Central Billing Department

*Presented at A.G.A. Convention, October, 1935.



In the event of an unusually large, or small, consumption, in comparison with previous months, the meter reader initials the sheet to indicate that the variance was noted and is correct.

At the close of each day during which the meters were read, the meter reading books are packed in specially constructed cases for shipment to the central billing department where the billing for all offices is done.

Printing and Addressing Bills

On the day that the meters of a given route are being read, the addressing division of the central billing department prints and addresses the bill forms of that route, preparatory to the actual billing work.

The addressing division keeps an address plate in its files for each customer's account, filed in the same order as the accounts appear in the meter reading books. For every change in the meter reading records a corresponding change is made in the address plate files.

Four model 3700 bill printing and addressing machines are used to print and address the bill forms. In addition to the name, address, meter numbers and account number on each of the four parts of the bill, the machines also print the meter reading dates and the number of days covered by the bill, on both the ledger record and the customer's copy. In addition a serial number is printed, in triplicate, on the ledger record, the cashier's coupon, and the representative's coupon. This serial number is helpful when sorting paid coupons and for the ready identification of accounts when posting cash.

The National Billing Machine

The National billing machine has three outstanding characteristics, namely, gang printing, totalizing capacity, and production aids.

Gang Printing

One of the most important features of the National machine is that the billing data entered in the machine are printed simultaneously on the four parts of the bill and on the proof sheet. This gang printing, which eliminates repeat printing and therefore eliminates carriage travel, is accomplished by a series of printing mechanisms, actuated by one set of keys.

Billing data can be blocked out on certain copies of the bill. For example, only the amount of each charge and the rate schedule symbol are shown on the cashier's coupon and on the representative's coupon. The meter readings and consumption, which are shown on the other copies of the bill, are blocked out.

Totalizing Capacity

The National machine can be built with 27 accumulators which under certain conditions can be expanded to 54, by using the "split keyboard" feature. Item counters on the machine accumulate the number of items in each accumulator. The net total of each bill is obtained automatically from the crossfooter and printed on the bill by depressing the "Total" motor bar.

If the split keyboard feature is used each of the accumulators has a capacity up to 99,999 units for either consumption or money.

Production Aids

In order to facilitate the billing operation, the machine is equipped with various aids to production such as bill feed and ejector, adjustable meter book holder, rate chart holder, and adjustable lamp.

The bill is inserted at the lower front of the machine, convenient to the operator, and ejected automatically. The keys for selecting the registers are motorized, making it unnecessary to depress an additional motor bar.

Billing Procedure

The procedure followed by the billing machine operator for the actual preparation of the bill is as follows:

After the operator has made cer-

National Cash Register's Exhibit during A.G.A. Convention, Chicago, October, 1935, where operators prepared 1,010 straight gas bills in one hour in a demonstration test.

tain that the name and address and meter reading dates previously addressographed on the bill form correspond exactly with the data on the meter reading record, the bill is inserted in the machine. The present and the previous meter readings are obtained from the meter reading record, entered in the machine, and printed simultaneously on the ledger record, customer's bill, and proof sheet.

The gas consumption as shown on the meter reading record is checked by the billing machine operator for accuracy, and entered in the machine. The amount of the bill at the correct rate schedule is then determined by the operator and entered in the machine, and the proper rate accumulator key is depressed. The consumption prints on the ledger record, the customer's bill, and the proof sheet. The money and rate symbol print simultaneously on the four parts of the bill and on the proof sheet. The word "GAS" prints on the customer's bill when the rate symbol key is depressed.

After the gas account is billed the same process is continued for the electric account.

The bill for gas and electric service is then totalled by depressing the "Total" motor bar, and automatically ejected from the machine.

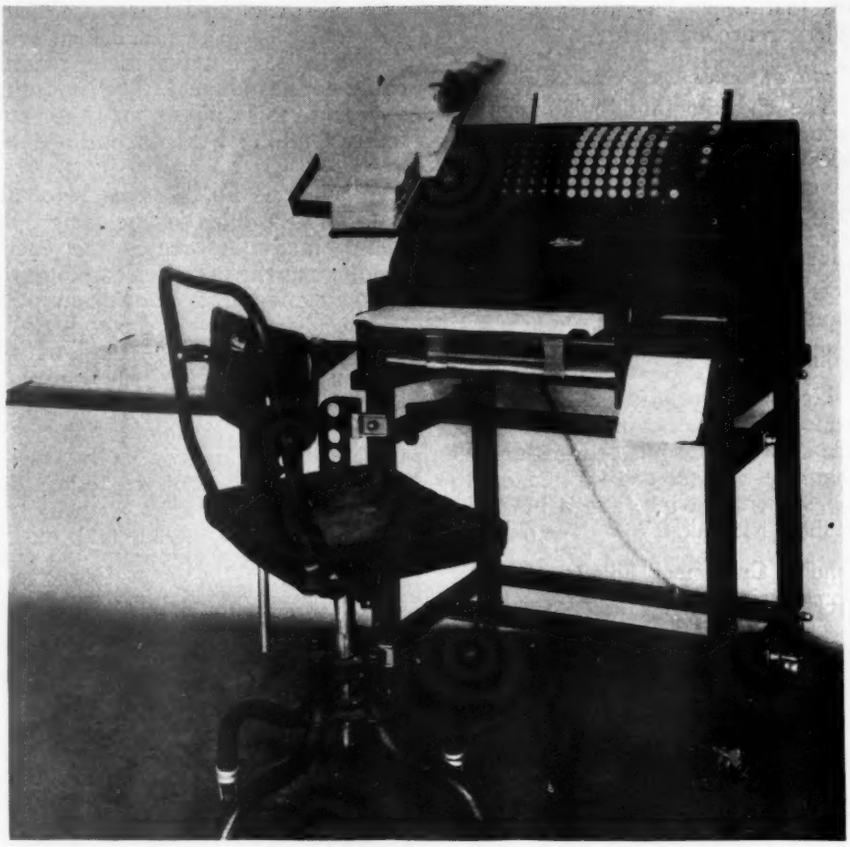
When all the accounts in the meter reading book have been billed, the totals for that book are printed on the proof sheet by depressing the motorized accumulator keys. Totals of all present readings and all previous readings, as well as the total consumption and money at each of the gas and electric rates, are shown. These totals are used later in the balancing procedure.

After the bills for each meter reading book have been prepared, the billing machine operator checks the total consumption as shown on the proof sheet, to determine that the total consumption for all bills equals the difference between the total present and previous meter readings. As an aid to this proof of total consumption, sub-totals are recorded by machine on the proof sheet at intervals of about every 75 bills.

Checking Bills

As soon as the meter reading books are billed they are forwarded to the bill auditing division, together with the bills and proof sheets, where it is determined that the bills are correct in every detail.

The first operation is to check each bill against the corresponding account in the meter reading book to insure that a bill has been prepared for each account, and that the customer's name and address, the reading dates, the kilowatt hours and the cubic feet have been correctly recorded, and that the correct constants, special minimum and proper rate have been applied.



National Billing Machine

Analysis and Proof of Electric and Gas Sales and Revenue

The analysis and proof of electric and gas sales and revenue, which follows the checking of the bills, is done by hand methods on specially designed proofs and analysis forms, which are used for the following purposes:

(a) Sales analysis and proof of consumption, both electric and gas, by meter reading books;

(b) Proof of revenue, both electric and gas;

(c) Summary of analysis of sales;

(d) Summary of monthly consumption and revenue;

(e) Audit of gas meters billed.

Sales Analysis and Proof of Consumption

The first step in the analysis procedure is the recording by hand, by the "tick" method, of the number of customers at each consumption block, by rates, and in the case of gas by major classes of business. This is done directly from the meter reading books, after the bills have been prepared on the National machines. The number of customers at each block are then added and the total multiplied by the consumption block. These consumption totals are added and the totals by rates are balanced with the corresponding consumption totals for that meter reading book, as shown on the proof sheet obtained from the National billing machine.

Proof of Revenue

After the consumption for each book has been balanced, the revenue is proved by adding the consumption for each block of the rate and multiplying by the rate. This is done on a calculating machine. The revenue for each block of the rate, and the total revenue, are recorded and at the bottom of the proof and analysis form. The total revenue for each rate is balanced with the corresponding totals, by rates, as shown on the proof sheet obtained from the billing machine.

Audit of Gas Meters Billed

The audit of gas meters is obtained by determining the total number of customers shown on the analysis form for each meter reading book, plus total excess meters. This figure must balance with the meter summary maintained independently in the meter record department. This veri-

fies that every gas meter has been billed or accounted for.

Audit of Sales

The checking and balancing procedure provides a complete audit of sales before the bills are delivered to the customers. Each office is charged daily with the total of the audited sales and held responsible for the total which must be accounted for either in cash or in delinquent outstanding.

Billing Arrears

Upon receipt of the bills in the commercial offices, any past due electric lighting and gas charges or merchandise charges are written on the bill in pen and ink, and a new total is shown in ink.

Sending Customers' Bills to Commercial Offices

The billing schedule is so arranged that customers receive their bills three working days after the meters have been read.

Delivery of Bills to Customers

Over 90% of the bills are delivered by company bill deliverers. An effort is made by the bill deliverer to collect the amount of the bill upon delivery. If the account is not paid within the allotted time, depending upon the credit standing of the customer, it is assigned to the collection department for follow-up by the collection representatives.

Estimating Meter Readings

About three years ago Public Service Electric and Gas Company adopted the plan of rendering "averaged bills" if the actual meter reading could not be obtained. The procedure covering this phase of the customers' billing work is outlined below.

When it is not possible to obtain an actual reading of the meter, the meter reader estimates the meter readings at the premises based on the following factors: The consumption shown for the preceding three months; the seasonal trend of the monthly consumption; the consumption for the corresponding month of the previous year; and local conditions. The estimated reading is recorded on the meter reading record in the same manner as if the actual reading had been obtained except that the code "E.R.," indicating "Estimated Reading," is recorded to the left of the meter reading.

The meter readings of certain customers are not estimated. For example, customers billed at certain rates are excluded, as well as all customers whose normal consumption exceeds a certain figure. Meter readings are not estimated for any customer for more than two successive months.

Also, if for any reason the customer has requested the company not to estimate his meter readings, the meter reading record is stamped "Do Not Estimate."

Billing Estimated Meter Readings

Estimated meter reading accounts are billed in the same manner as all other accounts except that the billing machine operators and the bill auditing clerks check the estimates to determine whether or not they appear reasonably accurate. If there is an apparent discrepancy in the estimate, the account is billed but the ledger record copy of the bill is marked "Special Attention." Each such account is investigated locally before the bill is delivered.

Each section of the four-part bill is stamped "This Is An Averaged Bill" and a sticker with the following wording is attached to the customer's bill copy:

This Is an Averaged Bill

Our representative was unable to obtain your meter readings on the regular reading date. In order to avoid too long a billing period, your meter readings have been estimated. This estimate is based on your use of service in previous months.

If you desire to have a bill based on actual readings, please show the positions of the hands on the meter dials on the back of the attached bill and return it to the company. If your reading warrants it, a corrected bill will be mailed to you.

Directions for Recording Meter Readings:

Mark positions of hands on meter dials on the back of your bill, drawing lines from outside of circle to center. If your meter has only three dials, use the three right-hand dials on the form. Please show the date of your reading.

(Continued on page 34)

Low-Cost Oxygen For Gasification Of Fuels

Theodore Nagel

Vice Pres., Carburetted Gas, Inc.
New York

OXYGEN of any desired purity can be continuously produced by fractional distillation that separates most of the nitrogen from air previously liquefied through compression and heat extraction.

In recent years the improvements in the art of air liquefaction and distillation have consistently increased the production capacity of the air process units constantly reducing the initial air compression pressure, lowering the operating cost and the cost of processing plant to successfully overcome the heretofore economic obstacle to the use of oxygen for the gasification of fuels. Single unit air fractionating operations have been increased to process air volumes containing in excess of 2½ million cubic feet oxygen in 24 hours.

Continuous production of oxygen in single unit large volume requires 450 K.W.H. per ton oxygen of 95% purity (23,800 cu. ft. at 60°F. and 30" Hg.), the oxygen output in 24 hours from 80 cu. ft. free air per minute compressed to not more than 15 atmospheres pressure. At 5 mills K.W.H. switchboard cost the power cost of 450 K.W.H. required to produce one ton oxygen of 95% purity is $2.25 and the operating cost $0.75 making the plant production cost $3.00 per ton which cost is equivalent to 12.6 cents per thousand cu.

Low-cost plants of large capacity single units are available for producing low-cost impure oxygen for use in gasifying fuels. Operating cost data confirm the production cost of oxygen. Inclusive of the capital charges the production cost of oxygen reported in "Stahl and Eisen" 1935, 55-860 vary from 7 to 10 Rm. per thousand cubic meters dependent on the purity. Cubic meters converted to cubic feet (at 60°F. and 30" Hg.) and Rm. (at par value 40.33 cents) converted to dollars, the converted costs vary from 8 cents per thousand cubic feet oxygen of 80% purity to 11.85 cents per M.C.F. oxygen of 95% purity.

The Future of the Small Gas Company

By

Ellis Mills

Manager, Piedmont Gas Co., Hickory, N. C.

JUST what is the future of the small gas company? Will it ever get back on a sound financial basis or will unfair government electrical rates gradually force it out of business?

Probably every small operator in the country is asking this same question and probably there are many who are better qualified to answer this important question than I am. However, I feel that a short account of what we have done here in Hickory, N. C., in the last eighteen months may be of interest to some of the other small companies who are faced with the same problems as ourselves.

The Piedmont Utilities Company was formed in the summer of 1929 with a capital of $200,000. This was later increased to $403,000 as more money was needed to lay the 64 miles of mains. The plant was built large enough to take care easily of the expected 2000 customers—actually only about one-fourth of that number were secured.

During the four years that it had been operating the company had steadily lost money. It could not even meet operating expenses, much less pay interest on its $150,000 bond issue and dividends on its $280,000 worth of preferred and common stock. In short, the company was hopelessly over capitalized. To what extent the $403,000 required to build the plant and lay the mains was wasted I am in no position to say.

When I first established connections with the company, it had no money in the bank; taxes were long past due; coal companies, oil companies and appliance manufacturers were trying to collect about $9,000 due them on accounts some of which were over two years past due. The local credit rating of the company was poor and its goodwill in the communities served might be classed as distinctly negative. Worst of all, it was losing some of its 540 customers to the electric company. This was partly due to poor service and partly to the fact that the company had no salesmen and no merchandise to display. The electric company had

a very strong hold on two of the towns, and with unlimited financial support and high pressure sales methods the gas company was hopelessly outclassed. Obviously something had to be done at once.

While the above situation sounds pretty bad, I believe it was no worse than that of some other gas companies in this section of the country.

In a round about way I became interested in the property and came down here in the fall of 1933. Before I had been here long I became convinced that this was a wonderful property if it could be put on a sound financial footing. As a first step we reorganized as the Piedmont Gas Company. The bond holders, preferred and common stock holders and those who held notes of the company turned them in, and received in exchange $140,000 of new bonds, on which no interest is to be paid until 1938. We authorized a total of $50,000 worth of common stock to be issued to people investing new money in the company. For every $1000 invested in the new company the investor got a $1000 bond and $1000 worth of common stock. We raised about $35,000 in this way, but decided to use no more of this money than was absolutely necessary.

We first went to the various creditors and after explaining the situation were able to make satisfactory settlements with nearly all of them. Within six months we had paid off all our back taxes, had all over due accounts caught up and had succeeded in establishing a good reputation for ourselves.

During this period of financial adjustment we did not neglect either the operating or the sales end of the business. The men working for the company were at first rather a discouraged group; so we tried to inject some pep into them, and those who responded are still with us.

We were told that our main line to Lenoir, a distance of 18 miles, was in terrible condition and as our line loss was 47% it was not hard to believe. We went over the line carefully and were fortunate in finding that the bad conditions were not general but were restricted to comparatively small sections; these we quickly replaced with new pipe and had the satisfaction of seeing the line loss drop to 14%.

Next we cut our gas rates so as to be well under those of the electric company. We saw to it that our gas was of good quality and above all else we gave real service. Two salesmen were added to our list of employees and they have been producing results.

What we have actually accomplished tells the story. We now have 700 customers, a gain of about 160 or nearly 30% in eighteen months. New appliances have been added to our old services so that our gas sales are up 50%. We are selling close to $18,000 worth of merchandise a year and feel that we are just getting started. The electric company has taken two customers away from us while we were getting 46 from them. Do not think for a moment that they do not give us real competition. They have the money to run huge ads in the paper and put on big cooking schools. They practically control the local paper so the case of a person getting

a headache from breathing gas in Los Angeles is made into an event of national importance. To a large extent we are able to counteract such publicity by a more personal intimacy with our customers. The people of the towns more or less realize we are up against a tough proposition and they go out of their way to help us wherever they can.

We feel that without question we have built up good will to the point where we are more popular than the electric company and we have done this because we realized that we had to.

To date we have used less than half the new money subscribed; and it looks as if we should not need any more to make the company a success. As already mentioned, we have paid off all our taxes and over due accounts; we have fixed up the lines; we have added two high pressure tanks at the plant; we have relined our two six-foot water gas sets; we have money in the bank and we have over three times as much owed us on merchandise as we had a year ago.

Perhaps it is over optimism or lack of experience that makes us think that we are on the road to success, when everyone else seems to have a hard luck story. Perhaps it is our youth. There is not a man in the organization who has reached 30.

We are just getting started; but we feel sure that we are going to beat the T. V. A. and the electric company; that the 28,000 people living along our gas mains are going to learn that gas is the ideal fuel and that there is no substitute for it.

Book Reviews

An Introduction to Gas Utility Accounting, by Collis Porter Thompson (Formerly with Los Angeles Gas and Electric Corporation Accounting Department). Edwards Brothers, Inc., Ann Arbor, Mich., 1935. 135 Pages. Price $2.00.

This book is primarily for gas utility employees, for practicing accountants, and for students of accountancy. Its purpose is to provide an introduction to the accounting problems peculiar to the gas utility industry and to present the methods used in their solutions; to evolve principles therefrom; and to make comparisons with general accounting principles of other commercial units. It is exactly what its title indicates—a short and readily understandable work on gas utility classifications of accounts, books of account and accounting methods. It is not intended to be a complete treatise on the subject.

The book contains chapters on the following general subjects: The Nature of Gas Utilities and Their Accounting Problems; Departmental Organization of an Operating Gas Utility; State Regulation of Gas Utilities and Uniform Classification of Accounts, and Accounting Books and Records. Then follow chapters covering specifically accounting for (1) Fixed Assets; (2) Accounts Receivable; (3) Materials and Supplies; (4) Sinking Funds and Miscellaneous Assets; (5) Long Term Debt; (6) Current and Accrued Liabilities; (7) Reserves, Capital Stock and Surplus; (8) Income; and (9) Expense.

Mr. Thompson's book will be welcomed as a much needed correlation of the very scattered literature on the elements of gas utility accounting.

Steel Plates. A Ready-Reference Handbook for Designers, Fabricators, Engineers and Consumers of Steel Plates. Published by Bethlehem Steel Company, Bethlehem, Pa. 1935. 362 Pages. Price $1.00.

Almost every gas engineer and designer or builder of gas plant equipment should find this handbook of real value and everyday practical usefulness. Outside of moving machinery, gas plant apparatus is made very largely of steel plate. This handbook provides in one compact volume all of the technical data which a person dealing with steel plates or flanged-plate products might need.

The publisher states that the purpose of the book is to provide the necessary working data, such as tables, specifications, general engineering and metallurgical information, helpful to designers, fabricators, and other users of steel plates, flanged-plate products and tubes. In the gas industry this would include those having to do with the design, construction, repair or purchase of holders, tanks, water gas sets, condensers, scrubbers, purifiers, boilers or pressure vessels.

The subject matter is simply though technically treated. The tables and cuts are clear and understandable. The type is excellent. In fact the whole make up is such that the information on any subject covered may be quickly and easily located.

Under each of its five main divisions is correlated all the pertinent data thereto, making it unnecessary to refer to other sources for specific information: Part I is concerned with manufacture, specifications, tabulated data and applications; Part II covers flanged and dished heads; Part III deals with tubes; Part IV takes up boiler design, riveted joints, welding, etc.; Part V includes indispensable engineering tables, such as functions of numbers, natural trigonometric functions and so on. For convenient recording of additional notes or information blank cross-section sheets are inserted next to the index.

This copyrighted volume is made up in fabrikoid covers, 6½x9¼ inches, with title and trade-mark lettering stamped in gold.

Flow of Natural Gas through high pressure transmission lines by T. W. Johnson and W. B. Berwald of the United States Bureau of Mines. Cost of printing defrayed by American Gas Association. Copies can be secured from American Gas Association, 420 Lexington Ave., N. Y. Price $1.00.

This report covers the results of tests made in cooperation with the American Gas Association on the flow of natural gas through high pressure transmission line. The results of these tests are then compared with the various existing formulas for flow in high-pressure lines, and the conclusion is reached that for practical purposes the Weymouth formula gives the most satisfactory results for pipes 6 inches or more in diameter.

The various high-pressure gas flow formulas are reviewed and the derivation of each is explained. The Reynolds' criterion and its use are also covered. It appears that the latter may prove to be of considerable help in the eventual preparation of a formula for the flow of gas in high-pressure lines smaller than 6 inch. At present the experimental data covering such lines is very limited.

The report also discusses the application of the flow formulas to parallel lines and to lines composed of pipe of different sizes. Methods of increasing line capacities by paralleling are explained and specific examples are worked out.

Of necessity the report is for the most part highly technical. It covers both the theory and practice of high-pressure gas transmission with commendable thoroughness. All of those who have to do with major technical problems of gas tranmission should find the report useful.

Domestic Gas Utilization

Water Heating Division—Part VIII

Competitive Water Heating

By

Charles W. Merriam, Jr.

Div. Commercial Manager, Roanoke Gas Light Co.
Roanoke, Va.

THE human characteristic of supposing "the grass to be greener in the other fellow's yard" is a disease common to the many gas salesmen when sales resistance occasioned by other fuels is encountered. Such an attitude, expressive of an inferiority complex, is born in the majority of instances either from consideration of only the original apparatus dollar cost or from failure to properly ascertain and to establish in the prospect's mind the *total cost per gal. of hot water delivered.* Some prefer to treat the sales problem of competitive fuels with a supercilious shrug of self-assumed superiority which if gracefully introduced, is admittedly a potent argument with a number of people. A perhaps more modern sales approach is to combat the claims of the coal, oil and electric people with pressure skillfully applied on the inherent weaknesses of the opponents' defenses. This latter course is, however, impossible to pursue unless gas salesmen have probed out the merits and demerits of other fuels with sufficient thoroughness to do otherwise than naively accept competitive sales talks on their face value with but faint protest.

This article undertakes to enumerate and partially analyze in as fair a manner as possible, the strengths and weaknesses of competitors only that the relative position of the automatic gas-fired water heater might be better understood. As a major premise the assumption can be safely made that the buying public is primarily concerned with the relative cost of a given quantity of hot water ready available at suitable temperature when and where the demand for such exists—don't trifle with these fundamentals. When the answer to the cost phase of the problem is being examined, fairness to the customer's interests requires that all reasonable factors involved (both apparent and unseen) be evaluated. In order to convincingly defend our gas water heater sales story against the aggressions of competitors a basic understanding of the pros and cons of opposition fuels and probable performances is highly desirable, in fact, quite indispensable.

In the front rank is that redoubtable competitor, COAL. Wide fluctuations in both price and quality, to which are added the vagaries of both the human and the design factors influencing utilization efficiency, contribute to the difficulty of pinning down of this elusive adversary. Perhaps the two greatest sales obstacles are, first, convincing the public that coal-fired hot water service involves any fuel cost at all and, second, segregating the coal used for hot water from that required for other heating purposes.

In ordinary domestic use the following three methods of coal application are common for providing hot water:

1. Laundry, pot, jack or "bucket-a-day" stove.
2. Direct and indirect facilities auxiliary to the central heating plant (furnace coil, steam coil or indirect heat exchanger, etc.).
3. Water backs on coal ranges.

There are subdivisions and variations to the above too numerous to treat fully here, but these are the "rank and file."

Before delving into a discussion of these three general types of application, a bird's-eye view of coal as a solid fuel is beneficial in providing requisite background. The following represents the range of typical basic conditions of solid fuel usage for the heating unit proper and the hot water storage tank auxiliary thereto:

	Anthracite	*Bituminous*	*Coke*
Gross heat per ton "as received" in million Btu.	23 to 29	23 to 28	25 to 29
Ordinary cash, delivered & prices, in 1 ton lots	$9 to 6	$6 to 13	$7 to 16
Normal overall season efficiency of heater and tank, %			
"bucket-a-day" (all year)	5—25%	5—20%	10—25%
Coil in firepot (winter) .	10—30%	10—25%	15—30%
Indirect heat exchanger (winter)	15—35%	10—30%	15—35%
Heat utilized per ton of fuel fired, in million Btu.			
"bucket-a-day"	1.7— 7.2	1.3—5.6	2.5— 7.2
Coil in firepot	2.6— 8.7	2.7—7.0	3.8— 8.7
Indirect heat exchanger	3.5—10.2	2.3—8.4	3.8—10.2

The above gross heat values and range of prices per ton are scarcely open to argument. Demonstrating the foregoing coal efficiencies, with consequent effect upon "Heat utilized per ton—" will be undertaken first by discussing briefly the high lights of coal and its combustion under average home conditions.

Coal, like any other fuel, requires the supplying of oxygen from air to complete the process of combustion thereby resulting in the liberating of heat. What actually happens is that when coal is sufficiently heated to the point of burning, the volatile matter (i.e., tars, compounds of carbon and hydrogen, sulphur and hydrogen itself) are gasified, which, when intermixed with oxygen, burn to free the heat previously imprisoned in latent form in the coal. Such "fixed carbon" as is then present (high in anthracite and coke and low in bituminous coal) when first contacted by oxygen forms carbon monoxide gas which is combustible in the pres-

ence of more oxygen to become carbon dioxide plus heat. Other constituents of coal undergo a similar rapid oxidation in order to free "pent up" heat.* Note that the combustion of both fixed carbon and volatile matter requires a mechanical change into the form of gas before heat becomes available. Gas is in truth the primary fuel, apart from many full-lunged claims by gas advertising departments. The gas industry by distillation from coal (in the sealed retorts of coal gas plants) in the absence of oxygen procures unliberated heat in gaseous form which is cleaned of impurities and delivered to the customer appliance in such a manner as to insure controlled combustion resulting inevitably in the higher efficiency obtained with gas heaters.

Visualize momentarily the combustion chamber of a heater or furnace filled with lumps of coal, what are the conditions existing therein contributing to the low efficiency which emanates from the very nature of solid fuels such as coal or coke?

1. Excess air caused by:
   a.) Irregular depths of fuel bed due to
      1. Varying size of coal charges
      2. Varying firing intervals
   b.) Clinker and ash formation introducing uneven distribution of air.
   c.) Blow-holes in bed permitting passage of unused air.
   d.) Draft (hence speed of heat liberation) controlled by hand subject to human equation.
2. Banking during night and slack periods.
3. Lack of flexibility in dampering back.
4. Excessive radiation losses through chamber walls and floor.
5. Sensible heat losses in ash and "live coals" passing through grates.
6. Unburnt coal, complete or partial, dropping to ash pit.
7. Soot deposits and accelerated scale formation in high temperature zones retarding efficiency of useful heat transfer.

Cogitate then, in comparison, the contrast between gas and coal combustion: a.) air essential to combustion controlled as to amount so intimately mixed with gas as to require only a minimum, b.) all fuel completely burned, c.) combustion of gas starts or is suspended instantly upon thermostatic demand. To weigh unprejudicially these widely dissimilar conditions is to leave no doubt as to why gas is the more efficient thermally—and by a wide margin. Add to this the fact that hot water is circulated almost continuously through an uninsulated storage tank with substantial heat losses, (insulation on most domestic tanks would be unsafe) and you have the answer to the gross inefficiency of solid fuels relative to gas. Ponder all this, translate into your own words, the sales drive has the "kick of an army mule."

The case example following illustrates a straightforward method of calculation to determine relative fuel costs of coal and gas based upon the assumption of the delivery of equal quantities of hot water at similar temperatures. Beware—this is only for those genuinely interested in studying the hot water problem.

Assumptions Common to Each

Temperature rise 80° F., hot water delivered 1,700 gal. per mo. Heat absorbed in the water delivered = $8.33 \times 80 \times 1,700 = 1,132,800$ Btu. per mo.

Coal 27,000,000 Btu. per ton at $8.75 per ton bituminous (stove size) for use in BUCKET-A-DAY stove, seasonal overall efficiency 15%, heat usefully employed is $27,000,000 \times .15 = 4,050,000$ Btu. per ton fired. Then

$$\frac{1,132,880}{4,050,000} \times 8.75 = \$2.45,$$

which is the monthly cost for coal.

Gas 540 Btu. per cu. ft. at 0.90 per Mcf., seasonal overall efficiency 57%, heat usefully employed is $540 \times .57 \times 1,000 = 308,000$ Btu. per Mcf. fired. Then

$$\frac{1,132,880}{308,000} \times .90 = \$3.31,$$

which is the monthly cost with gas.

The above (which is amply obscured in equations) if analyzed correctly, emphasizes one prime essential, namely, that to accurately ascertain the fuel cost in any specific water heater situation the overall seasonal efficiency and the cost per potential million Btu. must be known. A second unavoidable truth stares one in the face, namely, to heat a given quantity of water through a given temperature rise demands heat from some source.

Doubtless some gas men will throw up their hands in holy horror that one of the fraternity, as in the foregoing, admit the fuel cost of coal to be less expensive than gas. For the conditions there described (90 cent gas and $8.75 coal) these are the facts—but are they so devastating? In the foregoing coal is $3.31 — 2.45 = $0.86 per mo. cheaper for the bare cost of gas fuel alone. Note that the coal used amounts to .28 ton, or 560 lb. per mo., which is 18.7 lb. per day—precious little coal, a fact illustrating to anyone conversant with the problem in the field how decidedly conservative the above coal estimates are. After all, a medium-sized bucket-a-day of bituminous "pea" is 28.3 lb., or 849 lb. per mon. Note that if a bucket-a-day (28.3 lb.) had been used to heat the above described water the overall efficiency would have been only 9.9% instead of the 15% shown.*

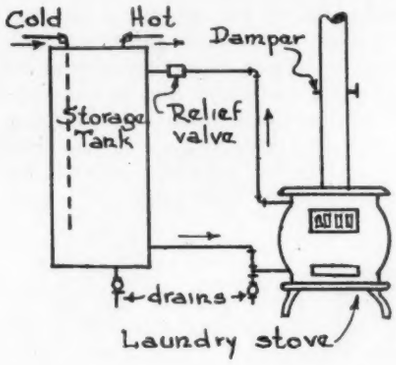
The question involved is can the 86 cents per mo. difference in bare fuel costs (less than 3 cents per day for these two fuel prices quoted) be sold to the public in exchange for ever present hot water at constant temperature without the fuss attendant to the use of coal?

The Bucket-a-Day (see sketch) is installed normally in the basement, but in some localities is found occasionally in the kitchen being used for space heating and bulk boiling operations in addition to pinch-hitting for a hot water supply. Virtually its one redeeming feature is initial cheapness, a saving which as a percentage of the entire hot water plumbing system, including sinks, tub, etc., is ridiculously trivial. In the kitchen the contrivance is ungainly, unsightly, unclean—figuratively, an eyesore and nuisance to everyone concerned. But remember that in the final analysis we are committed to

** This general subject is ably presented in "Principles of Combustion in the Steam Boiler Furnace" published by The Babcock & Wilcox Co. and more technically in "Fuels and Their Combustion" by Haslam and Russell, McGraw-Hill Book Co.*

** It is significant to observe in Bulletin No. 20 of The Anthracite Institute, which is so vituperative as to cast doubt on the correctness of the data contained therein, claims on Page 2 by calculation on 29,000,000 Btu. coal as tested with 87 gal. daily at 82° F. rise, an efficiency of only 22.8%. Note the comparatively large hot water usage. Quoting this source in its statement, "A fairly constant quantity of coal (17 lbs. per day) is required under all conditions of output," illustrates the lack of flexibility of the bucket-a-day stove. The cause of this inherent inefficiency of the coal heater is admitted inadvertently therein as follows, in an average of three tests, "fuel consumption during running period 8.4—during banking period 8.5." This trade association of the coal industry therefore admits that more fuel is used during the "banking period" (a complete thermal loss) than in the "running period."*

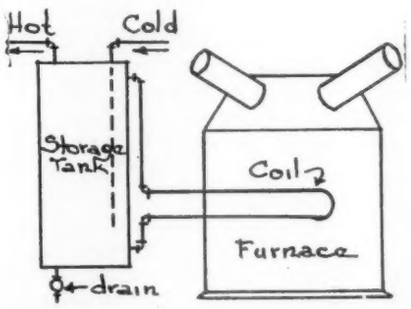
the belief that a gallon of water at given temperature is a constant fact, irrespective of the fuel employed. The preceding calculations have established that the "bucket-a-day" for those particular assumptions is slightly less expensive per month for fuel alone.* Do not overlook



Bucket-A-Day Stove

that extra cost per gallon of "tea-kettle" heating on the gas range, or the expense of grate, coil and flue replacement, or increased household and clothing cleaning bills. These cost factors alone more than offset the slightly greater fuel expense. What then? Does the promotion of family cleanliness due to automatic hot water service assist in keeping the doctor at arms length? Ask the busy housewife who once had a bucket-a-day and now owns a carefully selected and well installed automatic gas heater—removal would be akin to yanking molar teeth. And no value has yet been placed on the elimination of the attention required for or the delay incident to the bucket-a-day type.

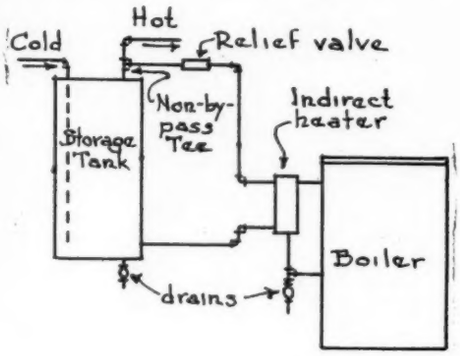
Furnace Coil



The Furnace Coil and its kin, the Indirect Heat exchanger (see sketches), are in rather general domestic use the country over, chiefly because the coal cost is hidden in the household heating bill. The conviction is so surprisingly wide-spread that "something is being gotten for nothing," a failing commonly indulged in by most Americans in more matters than that of water heating. That a certain quantity of heat from somewhere is indispensable need not be debated. The logic that such heat must be acquired from some source need not be pursued. That the heat absorbed in elevating water to proper temperatures cannot be used simultaneously for something else is self-evident, which means that heat absorbed in the hot water supply represents heat not available with which to heat the home. Fuel must be burned to produce heat. Therefore, coal, which costs money, must be burned specifically for the purpose of heating hot water used. The reasoning is infallible —"water does not run up hill and, literally, there is no Santa Claus." Were the hot water supply not obtained from a furnace coil or indirect heater attached to the house-heating plant, either less coal would be required there or what coal was burned would be used in heating the home better.

The statement is frequently heard within the gas industry that "each fifth shovel of coal is for the coil." Can this be demonstrated conclusively by data from disinterested sources? In September, 1930, Professor C. N. B. Hotchkiss, of Purdue University, submitted a paper to the Indiana Gas Association entitled, "The

Indirect Heater



Efficiency of Heating Water with Furnace Coil," the following table being an extract therefrom on a series of tests run in the Engineering Department on a boiler (Capital type of U. S. Radiator Corp., 550 sq. ft. of equiv. C. I. radiation), both with and without a furnace coil, to approximate ordinary daily domestic conditions (hand-fired with Illinois coal at 7 a.m., 12 Noon and 6 P. M.):

		Test A With Coil	*Test B Without Coil*
1.	*Coal fed to boiler, av. lb. daily*	*230*	*194.2*
2.	*Heat delivered to boiler, Btu.* ..	*2,800,000*	*2,273,000*
3.	*Hot water wathdrawn, gal.*	*73.7*	.....
4.	*Hot water temperature rise*	*94°F*	.....
5.	*Heat absorbed in hot water, Btu.* ..	*57,715*	.....
6.	*Total heat recovered, Btu.*	*1,374,926*	*1,178,410*
7.	*Total heat delivered for house heating only, Item 6-5*	*1,317,210*	*1,178,410*
8.	*Overall efficiency* $\frac{\text{Item 6} \times 100}{\text{Item 2}}$ ...	*49%*	*52%*
9.	*House-heating efficiency* ..... $\frac{\text{Item 7} \times 100}{\text{Item 2}}$	*47%*	*52%*

Inspection of Item 8 above indicates a decline in "total heat recovered" of from 52% to 49% or

$$\frac{52 - 49}{52} = 5.8\%$$ decrease in efficiency.

From "Test A with Coil," the deduction can be made that had the coil not been in the furnace the efficiency of Test B applies from which 1,317,210 ÷ .52, or 2,533,177 Btu. would have to be fired to obtain the required 1,317,210 Btu. for house-heating purposes. Hence, 2,800,000 — 2,533,177 or 266,923 Btu. represents the extra amount of heat fired in producing a hot water supply in which 57,716 Btu. were absorbed. Therefore, 57,716 ÷ 266,823 = 21.6%, or the useful heat secured in the hot water supply as delivered. Compare this 21.6% with the previous tabulation of efficiencies.

* *Considerable light has been shed on actual "bucket-a-day" heater costs by M. I. T. investigations (13,700 Btu. W. Va. bituminous) as published by the American Gas Association in "Final Report of Comparative Water Heater Tests," an average day summary following:*

Heat Input, Btu.	*1,440,000*
Av. tank temp., °F	*178.7*
Av. temp. rise, °F	*100.3*
Hot water, withdrawal, gal.	*50.0*
Heat Recovered in water, Btu.	*209,300*
Efficiency, %	*14.5*

Calculations from the above indicate that 21 lb. of coal per day (630 per mo.) were fired, or .42 lb. per gal. of hot water delivered.

The coal used in Prof. Hotchkiss's test was established as having a "Heating value (as fired) = 12,396 Btu. per lb." From this, then, 266,823 ÷ 12,396 = 21.5 or the lb. of coal fired that can be directly traceable in raising 73.7 gal. of water through 94° F. The conclusion is that 21.5 ÷ 73.7 = .29 lb. of coal (slightly more than ¼ lb. per gal.) were actually used per gal. of hot water produced. Assuming that the average family uses 50 gal. of hot water per day for a furnace coil operating through a 200-day heating season, then 50 × .29 × 200 = 2,900 lb. (1.45 ton) of coal per season for hot water heating. If the family used a 7-ton total for a season's heating then 1.45 ÷ 7 = 20.7% was for hot water or one out of each 4.8 shovels full.*

What are the chief conclusions to be drawn from these independent investigations on installations involving water heating as an adjunct to the central house-heating plant fired by coal? Summarize as follows:

1. The range of low thermal efficiencies set forth in the table—bituminous with coil 10-25%, anthracite with indirect heater 10-30%—are established as being generally sound and conservative.
2. Coal consumption specifically for hot water supply delivered is, roughly, ¼ lb. per gal.
3. The range of coal consumption is 1 shovel out of each 5 to 7 fired specifically for hot water supply delivered.

So much vagueness has surrounded the economics of the coil and the indirect heater as a competitor to gas that it has seemed necessary, with apologies, to indulge in the foregoing mathematical brain-sweating. Don't let anyone mislead you, now, that there is any such thing as "free" hot water from coal or any other fuel.

Many stalwart citizens labor under the illusion that the only cost of installation of a furnace coil is the direct labor and the few small pipe and fittings involved. It is rather common knowledge that the original cost of the indirect heater is considerably greater than the furnace coil although less maintenance is involved. The extra cost of required *added boiler capacity* to care for the hot water supply frequently equals or exceeds that of a first class automatic heater. Witness the statements of the American Radiator Co.'s 54th Edition, 1929, of "The Ideal Fitter," Page C48: "It (the coil) simply has the effect of adding the equivalent of a small amount of radiation to the boiler." And again on Page F53: "When domestic hot water is heated by a coil in the fire box . . ., the boiler load should be increased by an amount equal to 1½ sq. ft. of equivalent (240 Btu.) direct radiation for each gallon of tank capacity." In the case of a 30 gal. tank this means 30 × 1.5, or 45 sq. ft. of extra radiation due to the furnace coil. In the 1930 edition of the National Heating Guide, Blue Book of the Industry, Page 12, we find recommended as additional boiler capacity because of the furnace coil "multiply storage tank capacity in gallons—

For steam by..... 2.0
For water by..... 3.0"

Assuming the average domestic boiler at 250 sq. ft. of radiation, a furnace coil necessitating from 40 to 80 sq. ft. additional radiation becomes a considerable part of the original cost. Incidentally, the foregoing statements by representative plumbing concerns confirm again that the furnace coil does consume coal in furnishing hot water. Show these statements to the skeptics. Poor space heating in many homes has been remedied by jerking out the coil, thus increasing the boiler's ability to serve, unimpaired, for its primary function.

Now for some of the operating characteristics of the furnace coil. Being an auxiliary to the central heating plant, the coil supplies hot water, not according to the wants of the home owner for such, but rather according to the firing schedule imposed by the outside weather. This unavoidable difficulty imposes the restrictions of a dangerously overheated storage tank in cold weather and of an inadequate supply of hot water during mild weather. On the other hand, stoking up a furnace solely to provide hot water is a little like "the tail wagging the dog." The prevalence of only luke-warm water for morning shaving is traditional with furnace coils due, of course, to the night banking period. Turning off the radiators in the summer and firing the furnace to procure a supply of hot water is too ridiculous to discuss. The tendency of coils to lime up rapidly introduces maintenance burdens (replacements every 2 to 5 years) and also decreases the hot water supply. Cracked coils releasing water into the combustion chamber thus fracturing the furnace walls, exploded storage tanks in the heavy firing periods of cold weather and scalded hands from excessive temperatures are far from unknown.

The conclusions then respecting either the furnace coil or the coal-fired house heating plants are briefly:

1. Normally a minimum of 1/6 of the entire coal bill is for solely water heating.
2. To solid fuel costs must be added maintenance and depreciation nearly equal that of gas, and sometimes exceed.
3. Lack of temperature control leads to a definite hazard.
4. Temperature and quantity fluctuations of the available hot water supply make coal vastly inferior to that of an automatic heater.

The *Water Back* on a coal range can hardly be classified as a hot water service, the combustion chamber being so small as to preclude for all practical purposes the possibility of any but the most limited supply. With quite justifiable scorn, the water back is often referred to as a "dipper" service. Little imagination is required to visualize the added kitchen heat in the summer or the "muss" of the coal scuttle and ashes. The econo-

(Continued on page 40)

* *An independent corroboration of essentially the same conclusion as that arrived at by Prof. Hotchkiss for wintertime use, was reported in Aug., 1934 by Prof. G. B. Wilkes from tests performed at Massachusetts Institute of Technology. These conclusions were obtained with 13,050 Btu. anthracite coal in a steam boiler combined with an indirect water heater coil and recorded in the American Gas Association Interim Report on "Comparative Water Heater Tests," summary data on which follows:*

	Test A With Coil	*Test B Without Coil*
1. Coal fed to boiler, av. lb. daily....	*144*	*135*
2. Heat delivered to boiler, Btu.	*1,888,000*	*1,770,000*
3. Hot water withdrawn, gal. daily	*50*	.....
4. Hot water tem. rise	*120.6°F*	.....
5. Heat absorbed in hot water, Btu.	*50,410*	.....
6. Total heat recovered, Btu.	*1,120,000*	*1,100,000*
7. Total heat delivered for house heating only	*1,069,600*	*1,100,000*
8. Overall efficiency	*59.4%*	*62.2%*

Following the above M. I. T. figures through the same process of calculation as the Purdue data brings comparable conclusions; namely, the M. I. T. indirect heater showed a thermal efficiency of 30.9%, a coal consumption per gal. of hot water of 0.25 lb. and 1 shovel full out of a total of 5.6 was exclusively for water heating. These latter M. I. T. conclusions reflect the slightly higher efficiency of the indirect heater and of anthracite coal. The probability is that the improved conditions of laboratory test as contrasted with field conditions tend to make results better than in actual practice...The running of M. I. T. test at the rather small load of 175 sq. ft. of steam radiation influences the comparison with that at Purdue as well as the abnormal hot water temperatures.

Value of Photographic Enlargements In Window Displays

By Stuart Bratesman

Manager, Display Department, Boston Consolidated Gas Company

OF late, there has been a greater use of the photograph in window displays. By this, we do not mean the usual 8x10 print, but mounted enlargements which tell the story in clear, comprehensive terms.

There are, no doubt, many reasons for this wider use of the photograph. National advertising is using it more and more in telling its story to the public. It is only natural that window display pick it up, but there's a much different setup when adapted to the average gas company window advertisement. In the first place, the big reason photographs are used so much in printed advertising is that they are much cheaper than painted or drawn art interpretations. In window display, just the opposite is true. In most cases they run into more money, due to their gigantic size. For this reason, they are not used as much, but when properly handled make an effective message.

It has been found that enlarged photographs tell a more complete story in window displays based on educational or institutional themes. To illustrate this thought, there are two sets of this type shown with these lines. The photographs of the bakery, in the Industrial display, show the reader the complete story of gas in its uses in this particular installation. Words cannot express how effective and startling this six foot enlargement "got over" this story. Due to its size, this enlargement had to be made in two sections. It was probably one of the biggest photo enlargements made in the city served by the gas company using this particular display.

The other window display was used to tie-in with the recent home modernization activity conducted by the same company. Three model homes were built and completely equipped with the latest in gas equipment. Publicity was prepared during the vraious stages of this activity and released in newspapers and direct mailing pieces. The branch offices of the company, near the territory where these model homes were being constructed, had large window sets in their windows and mounted newspaper ads displayed on their sales floors inviting the public to visit the houses.

500 PIES BAKED AT ONE TIME WITH GAS
HAYES-BICKFORD'S
Gas helps in providing ideal working conditions, uniform results and quick production —with true economy

To adequately present the story of these model homes in window displays, large photographs were built into a series of backgrounds. It can be seen that this method was the only logical one to show the passers-by just what the houses really looked like. The effect was entirely unexpected. These displays stopped more people than any recent series used by this particular company. Especially at night, after the neighborhood theatres were over, it seemed that many home owners and suburbanites stopped and viewed this story of modern gas equipment and service.

As the old Chinese proverb goes, though some modern writers like to discount its originality, "One picture tells as much as ten thousand words."

"SUCCESSFUL SELLING"

Intensive Water Heating Drive Brings Good Results

Winfield Foster
Superintendent of Publicity
Peoples Gas Light & Coke Co.
Chicago, Ill.

WITH over 5,000 automatic water heaters added to the company's lines since January 1, 1935, a new sales record has been made by The Peoples Gas Light and Coke Company of Chicago. The record sales exceed the quota for the year and, according to C. H. Light, manager of the water heating division, are indicative not only of improved buying power, but of awakened interest in an essential home convenience. The addition to the company's annual revenue will be about $150,000.

The unparalleled success of the company's sales efforts in this campaign is attributed to three factors, one of them a relative newcomer in gas appliance selling.

The first factor was an intensive and carefully planned advertising program. Practically all available advertising media were used during the campaign, including radio, newspapers, and inserts in the gas bills to over 800,000 customers. The second factor was the unusually effective cooperation of Manufacturers and Master Plumbers throughout the city, who entered into an agreement with the gas company to sell and install the water heaters under an attractive Rental Purchase Plan. The third factor was a relatively small efficient group of water heating salesmen, divided into three districts in the city. controlled by the main office.

Supplementing this effort, an employes' prospect drive was conducted throughout the company, asking employes to get permission from their friends to allow a salesman to give them facts and figures on water heating with gas. Out of 5,315 prospects from employes, 1,502 resulted in sales.

The automatic water heating campaign was begun early in the year 1934 as the most intensive city-wide sales effort ever undertaken. The first year of the plumber-gas company water heating efforts were satisfactory, but the 1935 campaign, as early as April, showed much greater progress with over 600 sales. May was also a good month, but June broke two sales records. An all-time high had been reached for one month with 907 sales. The highest single day's sales in the history of the company, on June 29, saw 66 sales closed. Based on present indications, the total sales for the year 1935 should approach 5,400.

Out of the 5,000 sales made, sixty per cent were made by gas company water heating salesmen, and 40 percent by the plumbing contractors, the latter percentage indicating the effectiveness of the plumbers' cooperation.

One dollar down and rental payments of as little as 4c a day constitute the very liberal terms under which customers can have an automatic water heating equipment installed. The customer also has the option of purchasing the equipment at any time, with full credit for all rental payments previously made, and a 10% discount on the unpaid balance if paid in cash. Practically, this means the customer can actually try automatic service before definitely being committed to a purchase contract.

The rate for automatic water heating has a low step of 7c per therm, the cost to the average customer being approximately 10c a therm. The combination of low rate and relatively small rental payments for equipment has been the means of taking on a tremendous amount of business that could never have been sold under older deferred payment plans limited to 12 or 18 months.

In addition to the co-operative advertising, attractive displays, showing gas fired water heaters amid colorful surroundings, sounding a note of general cheerfulness, were installed in show windows by many plumbers. Similar displays were also shown during the summer at the gas company's main office, and the nine branch offices located in outlying business centers.

In hundreds of instances, salesmen and plumbers alike found that the gas company's proposition was not a new thing to the householder. They found that the majority of people comprising the water heating market "knew what it was all about" when the salesman called.

Sometime prior to the campaign a survey indicated that there were some 295,000 buildings in what might be considered the normal market for domestic water heating. 150,000 of these buildings were single-family dwellings, 115,000 two-apartment buildings, and 30,000 three-apartment buildings.

Gas is already extensively used for water heating in a large majority of these buildings, the saturation point being as high as 70% in the single-family dwelling group. Unfortunately, however, the manually operated side arm tank heater is the equipment through which hot water service is provided. In a large number of cases these tank heater customers use a coil in the furnace during the winter months. When, however, an automatic water heater is installed, the coil is invariably removed and we not only secure an all-the-year-'round customer but also an increase in consumption during the summer months; because when automatic service is available, the use of hot water shows a substantial increase.

The sales plan gives recognition to two important factors essential to successful utility sales promotion in new markets.

1. The importance of making the monthly cost of the new equipment and service to the customer as low as possible.
2. The advisability of developing and taking advantage of all available agencies for the sale of equipment.

The success of the campaign is evidence that automatic water heating with gas has been "sold" to the Chicago public in a way that indicates bigger and better campaigns next year and in the years to come.

2,643 Automatic Water Heaters Sold in Two Months

By C. L. Trevitt

Merchandise Manager,
Texas Cities Gas Company and Community Natural Gas Company

ACCOMPLISHING a feat that had been predicted by some to be "impossible," the Texas Cities Gas Company and the Community Natural Gas Company, units of the Lone Star Gas System, sold and installed 2,643 automatic water heaters during their September-October campaign. Carried on in 250 towns in Texas, the sales drive was the most successful of its kind ever conducted by the two companies. The number sold in the two-month drive plus other water heaters sold since January 1 brought the total through October 31 to 5,510.

With a quota of 2,500 units, a simple but definite sales program was constructed and an intensive follow through was effected. These two essentials—definite sales program and intensive follow through—produced the outstanding accomplishment in automatic water heater sales. The "impossible" quota was reached through the coordinated efforts and team work of all employes. Stenographers, cashiers, clerks, meter readers, shop men, salesmen—each employe turned his efforts toward selling.

Two essentials in securing volume sales were offered the customers. They were a small down payment and a similar monthly payment, which could be added to regular gas bills.

The water heater sales project was conducted in practically the same manner as all other sales programs are conducted by the two companies.

The system is divided into six divisions which are subdivided into a total of forty-eight districts. Sales activities are centered in the main office at Dallas and are carried out

under the supervision of the merchandise manager with the assistance of three sales supervisors working in close harmony with the division superintendents. Sales are conducted in each district under the supervision of the district manager, assisted by his district salesman.

In the September-October water heater drive our quota of 2,500 units represented one water heater sale for every fifty meters, after eliminating some of the small towns not equipped with water systems. Twelve district cash prizes were offered. Nine awards were in the offing for the first nine districts that sold the largest number of water heaters on a per meter basis. Three prizes were available to the three districts that sold the largest number of water heaters on a per meter basis to the consumers who previously had not used gas water heaters.

Each district team was furnished with a report each week. The report showed the weekly standing of each respective district as it compared with other districts. These reports effected a spirit of friendly competition, with each district team vieing with all others on a per meter basis.

Winner of the first prize in the campaign was the Clarksville district, with twenty-four units sold out of 410 water heater meters. Other districts that finished in the prize awards follow in the order named: Ennis, 107 sales out of 1,999 meters; Marlin, seventy-one sales, 1,351 meters; Seymour, forty-two-sales, 1,043 meters; Bowie, seventy-six sales, 1,787 meters; Mexia, sixty-six sales, 1,627 meters; Paris, ninety-three sales, 2,498 meters; Bryan, sixty-eight sales, 1,933 meters, and Vernon, forty-five sales, 1,234 meters.

Sherman district, with 4,472 meters and 120 sales, took first place in the new load competition. Waco district, selling 190 water heaters out of 9,990 meters, was second. Stamford was third, selling seventy-four water heaters out of 2,386 meters.

The recent water heater campaign was the third conducted jointly by the two companies since January 1. They sold 1,405 units during the first, and 1,131 units in the second.

Dealer Enthusiasm and Sportsmanship Outstanding Feature of Range Campaign

By F. S. Dewey

General Sales Manager,
The Union Gas & Elec. Co.,
Cincinnati, Ohio

WE are asked "what in our opinion was the most outstanding feature" during the recent National Range Campaign? That is a large order and the answer would depend from what angle it should be answered, the salesman's, the Public Utility's, the executives of the various cooperative dealers and the contact man's viewpoint. This being the first contest of a national nature wherein the local Public Utility attempted to have the local dealers cooperate in this sales campaign what struck us most was the spirit of sportsmanship and fair play displayed by the dealers not only among themselves, but their attitude also toward the Utility Company to safeguard our interests as well as theirs towards the goal of putting over this campaign.

Having decided to enter the Campaign the first step taken was to call a meeting of various dealer executives, with the Utility Company's representatives at which meeting the national campaign was outlined, the local market possibilities were given in dollars and cents value, the possibilities of the movement of "Modernize the Kitchen" presented and the value of appropriate advertising.

The next step was to perfect an organization and as our Utility did not want to take the role of a dictator we called upon Mr. Lynn Revenaugh, Manager of the Cincinnati Retail Merchants Credit Bureau to assume the chairman-